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MINERALOGICAL ABSTRACTS

Vol. 15—No. 3 September 1961

AGE DETERMINATION AND ISOTOPE MINERALOGY

ARNLEY (A. G.), HORNE (J. E. T.), SMITH (G. H.), CHANDLER (T. R. D.), DANCE (D. F.), & PREECE (E. R.). *Ages of some uranium and thorium minerals from east and central Africa.* Min. Mag., 1961, **32**, 716–724, 1 fig.

Using the complete lead method, the following ages have been determined: uraninite, Nkana, Northern Rhodesia, 2 ± 15 m.y.; brannerite, Kansanshi, Northern Rhodesia, 3 ± 15 m.y.; uraninite, Shinkolobwe, Katanga, 642 ± 20 m.y.; davidite [M.M. 29–101], Mavuzi, Mozambique, 8 ± 15 m.y.; monazite, Monkey Bay, Nyasaland, 597 ± 25 m.y.; samarskite, north-west Kenya, 635 ± 25 m.y. The significance of the results is briefly considered. R. A. H.

DULMIN (PRIESTLEY, 3d). *Geological significance of lead-alpha and isotopic age determinations of 'alkalic' rocks of New England.* Bull. Geol. Soc. America, 1961, **72**, 775–779, 1 fig.

Recent age determinations, which are tabulated, indicate that at least two groups of 'alkalic' igneous rocks exist in New England, with ages of about 185 and 270 m.y. Because of their lithological and geological similarities, all these rocks had previously been grouped with the White Mountains plutonic-volcanic series of New Hampshire. More detailed studies may show gradation of ages, or reliable petrological and geological data may be established for distinction of the groups. Meantime assignment to one group or the other requires caution. A. L. A.

VENKATASUBRAMANIAM (V. S.) & SIVARAMAKRISHNAN (V.). *Studies on the lead-alpha method of geochronology.* Journ. Sci. & Industr. Res., India, 1959, **18B**, 311–313.

Age determinations for a number of zircons and cyrtolite specimens were made using the lead alpha method. Experimental details are described and the results discussed in terms of earlier data. [M.A. 15–75] A. P. S.

ARNLEY (P. M.), FISHER (N. H.), PINSON (W. H., Jr.), & FAIRBAIRN (H. W.). *Geochronology of Proterozoic granites in Northern Territory, Australia. Part 1: K–Ar and Rb–Sr age determinations.* Bull. Geol. Soc. America, 1961, **72**, 653–662, 1 fig.

WALPOLE (B. P.) & SMITH (K. G.). *Geochronology of Proterozoic granites in Northern Territory, Australia. Part 2: Stratigraphy and structure.* Bull. Geol. Soc. America, 1961, **72**, 663–668, 1 fig.

Twenty-four K/A and two Rb/Sr age measurements on mica from granitic rocks intrusive into two subdivisions of the Lower Proterozoic in the Northern Territory of Australia show well-grouped ages averaging 1440 and 1630 m.y. Both groups of granites were emplaced at the end of a period of folding. A. L. A.

BAADSGAARD (H.), FOLINSBEE (R. E.), & LIPSON (J.). *Potassium-argon dates of biotites from Cordilleran granites.* Bull. Geol. Soc. America, 1961, **72**, 689–702, 4 figs.

K/A ages have been measured on 24 biotites from 20 plutons of the Cordillera of North America, principally from British Columbia. Samples were selected from well-known intrusive masses in an attempt to compare physically measured dates with relative age established by geological mapping; most dates correspond to the geological age interpretations. The ages fall into 5 distinct, widely separated groups, ranging in age from Devonian to Miocene. A. L. A.

ERICKSON (G. P.) & KULP (J. L.). *Potassium-argon measurements on the Palisades sill, New Jersey.* Bull. Geol. Soc. America, 1961, **72**, 649–652, 1 fig.

Three K/A age determinations on biotite are compared with seven determinations on whole rock samples of different phases of the Palisades sill. The argon retentivity of the fine-grained and chilled phases of the diabase is as high as that of the biotite, suggesting the possibility that K/A determinations on whole-rock samples of such rocks may give valid geologic ages. A. L. A.

GAST (PAUL W.), KULP (J. LAURENCE), & LONG (LEON E.). *Reply to Osterwald's discussion of 'Absolute age of Early Precambrian rocks in the Bighorn Basin of Wyoming and Montana, and southwestern Manitoba.'* Journ. Geophys. Res., 1959, **64**, 1344–1345.

The authors feel that Osterwald [M.A. 14-451] has taken too strongly their suggestion that metamorphism and granitization in the northern Bighorn Mountains can be correlated with that exposed in the Beartooth uplift. However, they defend the correlation which is based on structural similarities and a single biotite age of 2700 m.y. from the Bighorn Mountains. They argue that it is unlikely that the biotite sample has retained all its radiogenic argon and strontium through a younger metamorphic event.

F. R. B.

SMITH (D. G. W.), BAADSGAARD (H.), FOLINSBEE (R. E.), & LIPSON (J.). *K/Ar age of Lower Devonian bentonites of Gaspe, Quebec, Canada*. Bull. Geol. Soc. America, 1961, **72**, 171-174.

K/A ages for uppermost Lower Devonian (Lower Coblenzian) bentonites from Shiphead, Gaspé Peninsula, were determined on various minerals as : sanidine, 395, 384, 387 m.y. ; biotite, 376, 388 m.y. ; quartz-feldspar aggregate, 342 m.y. ; mixed-layer clay, 325 m.y. A. L. A.

GILETTI (BRUNO J.) & DAMON (PAUL E.). *Rubidium-strontium ages of some basement rocks from Arizona and northwestern Mexico*. Bull. Geol. Soc. America, 1961, **72**, 639-644, 1 fig.

Six Rb/Sr ages, ranging from 1210 to 1550 m.y., were made on micas from samples of basement rock from Arizona. An age of 490 m.y. was obtained on basement rock

believed to be of the same age. Four ages from 30 to 1 m.y. were obtained on micas from basement rock southern Arizona and northern Sonora, Mexico. A. L. A.

CATANZARO (E. J.) & GAST (P. W.). *Isotopic composition of lead in pegmatitic feldspars*. Geochim. Cosmochim. Acta, 1960, **19**, 113-126, 2 figs.

An ion-exchange method for extracting microgram quantities of lead from pegmatitic feldspars is described in detail. The lead content of 25 feldspars investigated ranged from <20 to 500 p.p.m., the amazonites or green micaceous clines all having 200 p.p.m. or more. The isotopic composition of the lead was also determined, and anomalous results explained. R. A. H.

HOLMES (A.). *A revised geological time-scale*. Transactions Edinburgh Geol. Soc., 1959, **17**, 183-216.

The Holmes B Time Scale of 1947 is critically considered and found in need of revision. A new time scale, based on numerous recent age determinations from all parts of the world, is proposed to take its place. The base of the Cambrian is now dated at 600 m.y. and not at 510 m.y. as previously. The estimated duration of the Jurassic and Permian periods is approximately doubled and the Triassic and Carboniferous periods extended by about 50%. A discussion of some of the geological implications of the new time scale is appended. G. P. B.

APPARATUS AND TECHNIQUES

Field and laboratory techniques

GÖNI (J. C.). *Nouvelle méthode de différenciation entre calcite et dolomite*. Bull. Soc. franç. Min. Crist., 1960, **83**, 254-256.

A new method for distinguishing between calcite and dolomite makes use of the strong fluorescence acquired by calcite when attacked by a saturated solution of uranyl acetate, followed by treatment with a 10% solution of ammonium acetate. Details are given for the treatment of thin sections. Dolomite is unaffected. R. A. H.

[ZHNERU (M. I.)] Жеру (М. И.). Метод полевой диагностики кальцита и доломита в архейских мраморах Слюдянки [A method of field determination of calcite and dolomite in Archaean marbles of Slyudyanka]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-deposits, Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, 349-352.

A modified Lemberg method is used. Filter paper moistened with ferric chloride is applied to a fresh surface of a rock sample and after a couple of minutes dried off

with another piece of filter paper. Under this treatment calcite acquires a brown colour, while dolomite remains unchanged. Other methods are also discussed. S. I. T.

BAILEY (EDGAR H.) & STEVENS (ROLLIN E.). *Selective staining of K-feldspar and plagioclase on rock slabs and thin sections*. Amer. Min., 1960, **45**, 1020-1025, 1 fig.

The surface of the specimen is etched for 3 minutes with conc. HF, dipped in water, then dipped quickly twice in a BaCl₂ solution, rinsed in water, and immersed face down for 1 minute in sodium cobaltinitrite saturated solution. The K-feldspar is stained yellow. After rinsing in tap water and briefly, in distilled water the surface is covered with rhodizonate reagent, 0.5g rhodizonic acid potassium salt in 20ml distilled water. The plagioclase becomes brick red. Excess rhodizonate is rinsed off. A. C. H.

LEHMANN (H.) & DUTZ (H.). [Infra-red spectroscopy as a method for the determination of mineralogical composition of ceramic raw materials and products. Transactions of the American Ceramic Society, 1959, **83**, 219.] Anal. Abstr., 1960, **3278**.

Infrared spectra of 70 silicates have been measured at wavelengths between 1300 and 417 cm^{-1} . The compositions of 5 two-component clays were determined by this technique to within $\pm 3\%$.

R. A. H.

HALLIMOND (A. F.). *On slow polishing*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1441–1446, 2 figs., 1 pl.

A light polishing machine is described, with interchangeable 6-inch laps, a speed of 90 r.p.m., and a weight of 1 lb. on each 1 inch mount, carried in a rotating holder. Diamond of grades smaller than 3μ , suspended in silicone liquid, is preferred, in conjunction with balsa wood laps. The soft constituents are finally polished with $\frac{1}{2}\mu$ diamond or alumina on cloth.

R. A. H.

AMSTUTZ (G. C.). *The preparation and use of polished thin sections*. Amer. Min., 1960, **45**, 1114–1116, 3 figs.

A method for the preparation of polished thin sections which requires from 25 to 35 minutes is described.

A. C. H.

HALLIMOND (A. F.). *Aluminium laps for polished sections*. Min. Mag., 1961, **32**, 738–739.

The use of thin aluminium foil attached to a paper backing, and mounted on a glass disc, is recommended for the preparation of polished specimens, in conjunction with 3μ diamond powder suspended in a silicone liquid.

R. A. H.

OLCOTT (GORDON W.). *Preparation and use of a gelatin mounting medium for repeated oil immersion of minerals*. Amer. Min., 1960, **45**, 1099–1101.

The gelatin content formula of Marshall and Jeffries [Soil Science Soc. America, Proc., 1945, **10**, 397] was increased from 0.1% to 1.0%. The technique of mounting, using, and washing the slides is given.

A. C. H.

SOREM (RONALD K.). *X-ray diffraction technique for small samples*. Amer. Min., 1960, **45**, 1104–1108, 5 figs.

The procedures for mounting particles of 10μ or less in size on gelatin fibres cut from a gelatin capsule, and for mounting the fibre specimen in the X-ray camera are described.

A. C. H.

KESSLER (F. M.). *Bestimmung der Änderungen des Gitterparameters verschiedener Graphite*. Collection Czechosl. Chem. Communications, Prague, 1957, **22**, 1097–1105, 3 figs., (Russian summary).

Current methods of determining lattice parameters of

graphites are considered and the advantages of the new method described. The beam from a Cr anode is applied for the first time in powder diffraction analysis. The merit and precision of the method are shown by applications to the determination of the lattice distances of rhombohedral graphite and to the study of the changes with temperature of the lattice plane separation in graphitized coaly material.

J. N.

WEBB (T. L.) & VAN DER WALT (T.). *Differential thermal method for determining reactivity of calcium oxide*. Nature, 1958, **181**, 411–412, 2 figs.

C. H. K.

CUTTITTA (FRANK) & WARR (JESSIE J.). *Preparation of lead iodide for mass spectrometry*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B487–488.

K. S.

GULBRANDSEN (R. A.). *Precipitation of salts from solution by ethyl alcohol as an aid to the study of evaporites*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B504.

K. S.

HOYTE (ALFRED F.). *A gamma-ray absorption method for the determination of uranium in ores*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B504–507, 1 fig.

The method gives reliable results on specimens which contain about 0.30%, or more, of uranium.

K. S.

MARTINEZ (PRUDENCIO). *Method of grinding cesium iodide crystals*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B507–508, 3 figs.

K. S.

Chemical : titrimetric

INGAMELLS (C. O.). *Method for 'ferrous iron' and 'excess oxygen' in rocks, minerals and oxides*. Talanta, 1960, **4**, 268–273.

The method depends on the stability of both Mn^{3+} and Mn^{2+} in phosphoric acid–pyrophosphate mixtures. The sample is dissolved in a phosphoric acid mixture containing an excess of Mn^{2+} , with or without the addition of standard oxidant, and the Mn^{3+} remaining in the solution, or produced by reaction with the sample, is titrated with $(\text{NH}_4)_2\text{SO}_4 \cdot \text{FeSO}_4$. The results agree well with those obtained by other methods, but the procedure is not applicable to samples which do not dissolve readily in the reagent, or which contain sulphur or organic carbon.

R. A. H.

BREŽNÝ (B.). [*The determination of ferrous oxide in chromium ore and in chromium magnesite.* Hutn. Listy, 1960, **15**, 552-554.] Anal. Abstr., 1961, **8**, abstr. 573.

The sample is dissolved in a mixture of sulphuric and phosphoric acids in the presence of an excess of ceric sulphate, the excess of the latter being titrated with a ferrous salt. R. A. H.

PINTO (C. MENDONÇA), MOYSÉS (E.), & TEIXEIRA (E. RIBEIRO). [*Determination of small amounts of uranium in minerals by the phosphate-vanadate process.* Fóton, 1959, **1**, 13-20.] Anal. Abstr., 1960, **7**, abstr. 3226.

The phosphate-vanadate determination of U is based on the precipitation of U^{IV} with sodium phosphate in acid solution and subsequent titration of U^{IV} with vanadate in H_2SO_4 . The method is simple and precise for the determination of small amounts of U in minerals and ores.

R. A. H.

SCHNEER (A.). [*Titrimetric determination of zirconium in 'red mud'.* Chem. Anal., Warsaw, 1960, **5**, 79-84.] Anal. Abstr., 1960, **7**, abstr. 4719.

Zr was determined after precipitation as Zr tetramandate, by titration either with $KMnO_4$ or $K_2Cr_2O_7$. For red muds containing $\approx 0.1\%$ Zr this was found more accurate ($\pm 6\%$) than the gravimetric method.

R. A. H.

LASIEWICZ (K.) & ZAWADZKA (H.). [*Volumetric determination of copper, lead and cadmium in pyrites, marcasite and their ash by sodium diethyldithiocarbamate.* Chem. Anal., Warsaw, 1958, **3**, 1033-1039.] Anal. Abstr., 1960, **7**, abstr. 1656.

R. A. H.

SHIRAISHI (I.) & SAITO (M.). [*Determination of a minute quantity of selenium in pyritic ores.* Rept. Techn. Iwate Univ., 1957, **10**, 46-51.] Anal. Abstr., 1960, **7**, abstr. 106.

Se is distilled as the tetrabromide and determined volumetrically by iodimetry. [M.A. **14-87**] R. A. H.

PERRIER (L.). [*Volumetric determination of tungsten in its minerals.* Bull. Soc. Chim. France, 1959, **26**, 177.] Anal. Abstr., 1959, **6**, abstr. 4750.

A solution of the mineral is acidified with H_2SO_4 and H_3PO_4 , passed through a Jones reductor, run into $10\% (NH_4)_2SO_4 \cdot Fe_2(SO_4)_3$ solution, and titrated with $0.1N KMnO_4$. Mo and V interfere.

R. A. H.

SAKHAROVA (YA. G.) & SHISHKINA (N. I.). [*Complexometric determination of fluoride in cryolite.* Zavod. Lab., 1959, **25**, 1442-1443.] Anal. Abstr., 1960, **7**, abstr. 3239.

R. A. H.

Chemical : colorimetric, spectrophotometric

WILSON (H. N.) & SKINNER (J. M.). [*An extraction procedure for the colorimetric determination of silica.* Rec Trav. Chim. Pays-Bas, 1960, **79**, 574-581, 2 figs.

The SiO_2 is converted into 12-molybdosilicic acid with sodium molybdate and then extracted with a 1% solution of tri-isodecylamine in toluene and the absorption measured at $460 m\mu$.

R. A. H.

SHAPIRO (LEONARD). [*Rapid determination of fluorine in phosphate rocks.* Anal. Chem., 1960, **32**, 569-570.

A rapid simple procedure is described in which the sample solution is passed through a cation exchange column after which a fixed amount of aluminium is added. Colour is developed by the addition of Alizarin Red S as in the method for aluminium [Parker & Goddard, 1950]. The absorbance is read at $475 m\mu$. Since fluoride diminishes the intensity of the colour complex its amount can be calculated by the use of standards.

D. A. M.

KUZNETSOV (V. K.) & TANANAEV (N. A.). [*Rapid method for the determination of gallium in nephelines.* Izv. Vyssh. Uchebn. Zavedenii, Khim. i Khim. Tekhnol., 1959, **2**, 840-842.] Anal. Abstr., 1961, **8**, abstr. 471.

The sample is decomposed by heating with NH_4F with subsequent photometry of Ga as the complex with rhodamine B in benzene.

R. A. H.

LUSHCHIK (YU. N.). [*Rapid colorimetric method of determining nickel in cobalt-arsenic ores.* Zavod. Lab., 1959, **25**, 801-802.] Anal. Abstr., 1960, **7**, abstr. 1764.

R. A. H.

PEARSE (G. A.) & PFLAUM (R. T.). [*Spectrophotometric determination of cobalt and nickel with oxamidoxime.* Anal. Chem., 1960, **32**, 213-215, 2 figs.

Nickel is quantitatively precipitated by $0.1 M$ oxamidoxime and filtered off. The absorbance of the yellow cobalt oxamidoxime complex in the filtrate is measured at $350 m\mu$. The nickel precipitate is dissolved and the absorbance of the solution is measured at $233 m\mu$. Various ions, particularly iron and copper, interfere and must be removed.

D. A. M.

RYAN (D. E.). [*The colorimetric determination of vanadium with benzoylphenylhydroxylamine.* Analyst, 1960, **85**, 569-574, 1 fig.

A selective spectrophotometric method has been developed for the rapid determination of V in chromit and other ores.

R. A. H.

OMPAAN (H.). *Colorimetric determination of vanadium*. Nature, 1957, **180**, 980.

The reaction product of vanadium and a hydroxamic acid can be quantitatively extracted with di-isobutylketone. Under certain circumstances the iron, titanium, and uranium complexes are not extracted. C. H. K.

WALLACE (GERALD W.) & MELLON (M. G.). *Spectrophotometric determination of vanadium as tungstovanadic acid*. Anal. Chem., 1960, **32**, 204-207, 4 figs.

A coloured complex, formed by condensation of the oxy-acids of W^{VI} and V^V in a 3 to 1 ratio, is used as the basis for a spectrophotometric method for vanadium. The complex has its maximum absorbance at 392 m μ . The colour is stable for at least 24 hours and follows Beer's law over the concentration range of 2×10^{-5} to 8×10^{-4} M vanadium. D. A. M.

WAKAMATSU (S.). [*Rapid spectrophotometric determination of sulphur and sulphate in pyrites, slag and sulphate compounds by the ferric sulphate complex method*. Japan Analyst, 1959, **8**, 372-377.] Anal. Abstr., 1960, **7**, abstr. 1719.

The absorption of the $Fe^{3+}-SO_4^{2-}$ complex in $HClO_4$ at 380 m μ is applied to the determination of S. R. A. H.

DEKHTRIKYAN (S. A.). [*Determination of small amounts of germanium in ores and minerals*. Izv. Akad. Nauk Arm. SSR, ser. Geol. i Geogr. Nauk, 1957, **10**, 121-128.] Anal. Abstr., 1959, **6**, abstr. 96.

Ge is extracted from the ore solutions with CCl_4 and determined absorptiometrically as molybdo-germanic heteropoly acid. R. A. H.

YEN (JEN-YIN) & TAO (TSENG-NING). *Separation of rhenium by co-precipitation and its determination in molybdenite*. Acta Chim. Sinica, 1958, **24**, 97-104.

Re can be completely co-precipitated with tetraphenylarsonium perchlorate. The precipitate is freed from molybdate, Re is brought into solution with hot water and $KClO_4$, and determined colorimetrically. [M.A. **13-142**] R. A. H.

POLUEKTOV (N. S.) & KONONENKO (L. I.). [*Determination of rhenium in molybdenite by a colorimetric method*. Zavod Lab., 1959, **25**, 548-550.] Anal. Abstr., 1960, **7**, abstr. 998. R. A. H.

HARA (T.) & SANDELL (E. B.). *Spectrophotometric determination of ruthenium with 1,4-diphenylthiosemicarbazide with special reference to meteorites*. Anal. Chim. Acta, 1960, **23**, 65-71, 3 figs.

Using 1-2 g samples, 0.5 to 15 p.p.m. of Ru can be determined at 560 m μ , following solution, volatilization as the tetroxide, and a chloroform extraction. R. A. H.

OZHIGOV (E. P.), DOROKHINA (A. N.), & MIRKINA (I. I.). [*Comparative evaluation of colorimetric methods for the determination of bismuth*. Vses. Khim. Obsch. im. D.I. Mendeleev, 1957, 79-87.] Anal. Abstr., 1959, **6**, abstr. 122.

The iodide and thiourea colorimetric methods for the determination of Bi in polymetallic ores are compared. The thiourea method is more economical, more rapid, and gives reliable results: the ratio of Fe to Bi should be $<100:1$. R. A. H.

KITAZATO (T.) & SAEKI (Y.). *Rapid determination of a small amount of selenium in sulphide ores*. Japan Analyst, 1959, **8**, 422-428.

Se is determined colorimetrically with 3:3'-diaminobenzidine, interference from metal ions being eliminated by the addition of EDTA. R. A. H.

PROSHKOVICH (M. F.) & FALEEV (P. V.). [*Analytical determination of selenium and tellurium in ores and their decomposition products*. Obogashchenie Rud, 1957, 21-24.] Anal. Abstr., 1958, **5**, abstr. 4082.

For the separation of Se and Te a solution of hydrazine in 28% HCl is recommended. For their determination photometry of their colloidal solution obtained by reduction with $SnCl_2$, or iodimetric titration, may be used [M.A. **13-434**]. R. A. H.

TKACHENKO (N. S.) & SAKUNOV (V. I.). [*Determination of arsenic in iron-manganese ores and agglomerates*. Trudy Nauk-Tech. Ob. Chernoi Metallurg., Ukr. Resp. Prav., 1956, **4**, 126.] Anal. Abstr., 1958, **5**, abstr. 4067.

An improved method for the photometric determination of As as the blue molybdoarsenic complex. R. A. H.

LUKE (C. L.). *Photometric determination of tantalum with phenylfluorone*. Anal. Chem., 1959, **31**, 904-906. R. A. H.

COOPER (J. A.) & VERNON (M. J.). *A reinvestigation of the determination of thorium with SPADNS*. Anal. Chim. Acta, 1960, **23**, 351-354, 4 figs.

The practical lower limit of determination of Th is 10 μ g, rather than the previously reported value of 0.04 μ g [M.A. **13-437**]. The method is applicable to the determination of low concentrations of Th in the accessory minerals of igneous rocks. R. A. H.

OTTERSON (D. A.) & GRAAB (J. W.). *Colorimetric determination of molybdenum in the presence of tungsten. Modified mercaptan method.* Anal. Chem., 1958, **30**, 1282-1284.

[M.A. **13**-256, 438, 571, 574].

R. A. H.

PATROVSKÝ (V.). [*Rapid determination of gold in ores and rocks for prospecting purposes.* Geol. Průzkum, 1959, 302-303.] Anal. Abstr., 1961, **8**, abstr. 35.

The finely powdered samples are dissolved, treated with KBr, extracted with ether, treated with salicylic and phosphoric acids and 1% benzidine in 20% acetic acid, and the absorption measured using a violet filter. R. A. H.

PATROVSKÝ (V.). [*Simplified method for the determination of gold for prospecting purposes.* Geol. Průzkum, 1960, 52-53.] Anal. Abstr., 1961, **8**, abstr. 458.

A colorimetric method in which the homogenized sample is treated with HCl and Br followed by KBr and salicylic acid, extracted with butyl acetate, and the extinction measured at 400 mμ. It is satisfactory for as little as 0.002% of Au.

R. A. H.

Chemical : various methods

DINNIN (JOSEPH I.). *Determination of total iron in chromite and chrome ore.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B476-477.

The silver reductor method is an alternative to methods described previously [M.A. **14**-381].

K. S.

RADER (L. F.), SWADLEY (W. C.), LIPP (H. H.), & HUFFMAN (CLAUDE, Jr.). *Determination of zinc in basalts and other rocks.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B477-480.

K. S.

WARR (JESSIE J.) & CUTTITTA (FRANK). *The determination of lead in iron-bearing materials.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B483-484.

K. S.

CUTTITTA (FRANK) & WARR (JESSIE J.). *Determination of lead in pyrites.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B485-486.

K. S.

CUTTITTA (FRANK) & WARR (JESSIE J.). *Determination of lead in zircon with dithizone.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B486-487, 1 table.

K. S.

CUTTITTA (FRANK). *Determination of small quantities of oxygen adsorbed on anatase.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B488-490, 1 fig.

K. S.

HUFFMAN (CLAUDE, Jr.). *Water-soluble boron in sample containers.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B493-494, 1 table.

K. S.

GRIMALDI (F. S.). *Dilution-addition method for flame spectrophotometry.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B494-495, 1 fig., 2 tables.

K. S.

SHAPIRO (LEONARD). *A spectrophotometric method for the determination of FeO in rocks.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B496-497.

Powdered orthophenanthroline is added to the weighed sample and is followed by H₂SO₄ and HF. The attack is carried out on a steam bath, the orthophenanthroline complexing the ferrous iron as it goes into solution. Sodium citrate buffer is added after the attack and absorbance of the resulting colour is measured in a spectrophotometer.

[M.A. **13**-257]

K. S.

BENNETT (H.), EARDLEY (R. P.), & THWAITES (I.). *Apparent loss of iron during fusion of silicate materials with sodium hydroxide in nickel crucibles.* Analyst, 1961, **86**, 135-136, 1 fig.

The loss of iron during fusion of silicates with NaOH in nickel crucibles is proportional to the amount of iron present and is possibly due to the formation of an alloy between the iron and the nickel of the crucible. R. A. H.

ASTAF'EV (V. P.). [*Determination of quartz and opal in rocks. Symposium : Determination of free silica in rocks and ore dust, Moscow.* Akad. Nauk SSSR, 1958, 51-53.] Anal. Abstr., 1960, **7**, abstr. 1037.

The method is based on the insolubility of quartz and opal in fused NaHSO₄.

R. A. H.

[BOGDANOVA (V. I.)] Богданова (В. И.). Хроматографическое отделение титана от ниобия и тантала и их разделение [Chromatographic separation of titanium from niobium and tantalum and their partition]. Мат. геол. руд. мест., лётр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-deposits, Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, 224-232, 3 figs.

S. I. T.

HISADA (M.) & KASHIKAWA (K.). [*Determination of zinc in ores by the use of an anion-exchange resin.* Japa. Analyst, 1959, **8**, 235-239.] Anal. Abstr., 1960, **7**, abstr. 1680.

R. A. H.

KALLMANN (S.), OBERTHIN (H.), & LIU (R.). *Determination of cadmium in zinc concentrates and other zinc-rich materials. A cation procedure.* Anal. Chem., 1960, **32**, 58-60.

Because of the formation of the CdI_4^{2-} complex, the iodide medium is well suited to the separation of cadmium from zinc by ion exchange. D. A. M.

U.K.A.E.A. *Analytical method for the general gravimetric determination of uranium in ores and concentrates.* U.K. Atomic Energy Authority, 1960, Rept. **PG 128(S)**, 9 pp.

The sample is dissolved in HNO_3 , evaporated to dryness, the residue dissolved in a mixture of $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$, $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, and HNO_3 , transferred to a cellulose-alumina column, and the U eluted with ethyl ether containing HNO_3 , which is then removed by distillation from water. U is precipitated with ammonia and ignited to U_3O_8 . For ores with 82% to 93% U the standard deviation $\approx \pm 0.08\%$. R. A. H.

BORLERA (M. L.). [Analysis of Italian uraniferous minerals. I. Leaching with dilute sulphuric acid and concentration on exchange resins. Ric. Sci., 1958, **28**, 331-340.] Anal. Abstr., 1959, **6**, abstr. 4430.

The determination of U in autunite and pitchblende is described. A five-fold concentration of U was obtained by passing the leached extract through a strong anion-exchange resin, U then being eluted with nitric acid. R. A. H.

UKAI (YASUO), KAWAKAMI (TAKAYA), & KIMURA (YASUHIRO). *The trial construction of fluorimeter and the microfluorimetric determination of uranium in zircon.* Journ. Japanese Assoc. Min. Petr. Econ. Geol., 1958, **42**, 249-256, 9 figs., 4 tables (Japanese with English summary).

The authors constructed a sensitive fluorimeter by using a photomultiplier tube as the fluorescence detector which multiplies the initial photocurrent several thousand times by means of secondary emission dynode stages. The dynode is fed with 100-150 volts per stage. The sensitivity of the fluorimeter can be varied over a wide range by changing the voltage per dynode stage or the load register of grid in bridge circuit, and by interposing the secondary filters in the optical pass. At the most favourable sensitivity, one scale division corresponds to 0.00014 mg of uranium. The quenching effects of Zr, Ce, and Th on uranium are also investigated. [M.A. **14-376**] I. S.

ADER (D.) & ALON (A.). *Rapid determination of beryllium: a paper-chromatographic method.* Analyst, 1961, **86**, 125-129.

Eriochrome cyanine R is used as colour-forming reagent in a simple and sensitive paper-chromatographic method for determining Be in ores. As little as 0.002 μg of Be can be detected, and visual comparison with standard chromatograms is satisfactory for determining 0.002 to 0.3 μg of Be. R. A. H.

KAVANAGH (J. M.) & BEAMISH (F. E.). *New fire assay for osmium and ruthenium.* Anal. Chem., 1960, **32**, 490-491.

Osmium and ruthenium are collected from ores and concentrates in an iron-nickel-copper button. The button collection is complete and the osmium and ruthenium are quantitatively dissolved and distilled by perchloric acid. Losses to slags and pots are negligible. Milligram amounts of the remaining platinum metals did not interfere with the determinations. D. A. M.

RASUMNY (J.). *Détection du gaz carbonique libre dans les minéraux.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **1**, 27-29.

A brief discussion on the detection and location of CO_2 of the order of a few mm^3 in minerals. Such measurements are important in the study of the geochemical cycle of carbon. R. A. H.

COULSON (C. B.), DAVIES (R. I.), & LUNA (C.). *Quantitative paper chromatography of inorganic ions in soils and plants.* Analyst, 1960, **85**, 203-207, 3 figs., 1 pl.

Cu, Co, Ni, and Zn are separated by paper chromatography. Cu, Co, and Ni are determined directly by means of an automatic-recording reflectance densitometer. The method has been applied to certain soils with typical values Ni 0.68 p.p.m., Cu 0.47 p.p.m., and Co <0.1 p.p.m. [M.A. **13-75**] R. A. H.

MEBIUS (L. J.). *A rapid method for the determination of organic carbon in soil.* Anal. Chim. Acta, 1960, **22**, 120-124, 1 fig.

By using 50 mg of soil and 10 ml of 0.2 N dichromate solution, samples with a carbon content up to 12% can be analyzed. R. A. H.

STOLYAROV (K. P.). [New methods for microchemical detection of vanadium and titanium. Vestn. Leningrad Univ., 1958, no. 10, Ser. Fiz. i Khim., 122-125.] Anal. Abstr., 1959, **6**, abstr. 2559.

For Ti the absorption band at 365 m μ of metatitanic acid, precipitated by 2N NH_4OH saturated with NH_4Cl , is used for detection. For V the red colour assumed by lead vanadate when examined in a UV microscope is used. The methods are applicable to sulphide ores. R. A. H.

ZIMMERMAN (J. BERNARD) & INGLES (JOHN C.). *Isolation of the rare earth elements. A chlorination-volatilization procedure.* Anal. Chem., 1960, **32**, 241-246, 1 fig.

Apparatus and procedures are described for the total chlorination treatment of radioactive ores and concentrates with simultaneous volatilization at 900°C. Most of the non-rare elements, including thorium and scandium, are eliminated and a subsequent ammonia precipitation removes the alkalis and alkaline earths and isolates the rare earths, including yttrium, in a pure concentrate suitable for weighing. In the case of chemical uranium and thorium concentrates, a preliminary extraction with a carbon tetrachloride solution of tributyl phosphate eliminates the bulk of these elements and permits the use of a larger sample, thus extending the range of the method. Over-all recoveries of the rare earth elements are 90% or better. D. A. M.

[TSEITLIN (S. G.)] Цейтлин (С. Г.). Применение этилендиаминтетраацетата натрия (трилона Б) в радио-химическом анализе [*The application of ethylenediaminetetra-acetate of sodium (trilone B) in radio-chemical analysis*]. Труды института геологии рудных месторождений, петрографии, минералогии и геохимии [Trans. Inst. Geol. of Ore-deposits, Petr. Min. & Geochem.], 1959, **28**, 148-151, 1 fig.

S. I. T.

BAGSHAW (B.). *Ferrous metallurgical analysis: a review.* Analyst, 1959, **84**, 475-504.

The determination of Al, As, B, C, Cr, Co, Cu, Pb, Mg, Mn, Mo, Ni, Nb+Ta, P, Si, S, Sn, Ti, W, V, and Zr is reviewed. There are 188 references. R. A. H.

AFANAS'EVA (L. I.). [*Use of EDTA in the separation of barium, strontium and calcium.* Zhur. Anal. Khim., 1959, **14**, 294-297.] Anal. Abstr., 1960, **7**, abstr. 398.

Ba can be quantitatively separated from Sr by precipitation of BaSO₄ from an EDTA solution at pH≈8. Sr and Ca can be quantitatively separated by the precipitation of SrSO₄ at pH≈5. R. A. H.

COPELAND (L. E.), BRUNAUER (S.), KANTRO (D. L.), SCHULZ (E. G.), & WEISE (C. H.). *Quantitative determination of the four major phases of portland cement by combined X-ray and chemical analysis.* Anal. Chem., 1959, **31**, 1521-1530, 3 figs. R. A. H.

PIÈCE (R.). [*Determination of calcium sulphate in gypsum and plaster by ion-exchange.* Rev. Matér. Constr. C, 1959, 107-110.] Anal. Abstr., 1960, **7**, abstr. 2635.

The ground sample is heated at 90°C with Amberlite IR-120 resin in water, the mixture is filtered, and the free H₂SO₄ titrated with NaOH. R. A. H.

HORR (C. ALBERT). *A survey of analytical methods for the determination of strontium in natural water.* Water-Supply Paper U.S. Geol. Survey, 1959, **1496-A**, 1-18.

The methods described include the gravimetric, volumetric, spectrochemical, polarographic, chromatographic, and radiochemical. K. S.

CUTTITTA (FRANK), SENFTLE (FRANK E.), & WALKER (E. C.). *Preliminary tests of isotopic fractionation of copper adsorbed on quartz and sphalerite.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B491-493.

K. S.

ANNELL (C. S.) & HELZ (A. W.). *Spectrochemical analysis using controlled atmospheres with a simple gas jet.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B497-499, 2 figs.

K. S.

STEVENS (ROLLIN E.), CHODOS (ARTHUR A.), HAVENS (RAYMOND G.), GODIEN (ELIZABETH), & NEIL (SARAH T.). *Combination of gravimetric and spectrographic methods in the analysis of silicates.* Prof. Paper U.S. Geol. Survey, 1960, **400B**, B499-501.

Spectrogravimetric analysis eliminates the possibility of gross error in the analysis for major constituents, improves the accuracy of the determinations of major constituents by determining the corrections needed to make them accurate, ensures that non-volatile constituents determinable chemically or spectrographically are not overlooked, and concentrates elements present in small quantity so that they can be measured [M.A. 15-51]. The precision achieved is indicated by duplicate analyses of olivine from poikilitic harzburgite, Mountain View area, Stillwater complex, Montana [M.A. 14-460, 15-58, 59]: SiO₂ 39.99, 40.01, Al₂O₃ 0.11, 0.14, Fe₂O₃ nil, nil, FeO 13.12, 13.14, MgO 46.14, 46.13, CaO 0.04, 0.04, H₂O+ 0.12, 0.05, TiO₂ 0.007, 0.005, MnO 0.17, 0.19, BaO 0.03, 0.03, NiO 0.19, 0.14, CoO 0.03, 0.03, Cr₂O₃ 0.02, 0.02, CuO 0.007, 0.002, Sc₂O₃ 0.01, 0.01, SrO 0.002, 0.002, ZnO 0.02, —, ZrO₂ 0.001, 0.001, Na₂O & K₂O not determined, = 100.01, 99.95; H₂O— 0.03, 0.02. K. S.

X-ray analytical methods

MOLLOY (MARTIN W.) & KERR (PAUL F.). *X-ray spectrochemical analysis: an application to certain light elements in clay minerals and volcanic glass.* Amer. Min., 1960, **45**, 911-936, 9 figs.

Elements with atomic numbers of 12 and greater can now be determined by X-ray spectrochemical methods. The modifications to the equipment include a helium atmosphere for the instrument path, methane-argon gas

and a linear amplifier for the flow proportional counter, and electronic pulse discrimination by means of a Pulse Height Analyzer. An analytical procedure is outlined which gives a rapid, non-destructive, qualitative, semi-quantitative, and quantitative analysis useful for aluminosilicate minerals and mineraloids. The method was applied to the volcanic and related materials from the Marysvale, Utah, uranium area ; the analyses indicate that the tufts, glasses, and rhyolites are derived from a uniform magma.

A. C. H.

ROBERT (M.), POMEY (G.), & ANGELI (M.). *Note sur le dosage des oxydes de fer par diffraction X*. Bull. Soc. franç. Min. Crist., 1960, **83**, 226–227, 1 fig.

The three oxides of iron are determined by comparison of the intensities of certain reflections with that of the 111 reflection of fluorite. Amounts of hematite and magnetite can be determined to approximately 3% for amounts around 50%.

R. A. H.

HERBSTSTEIN (F. H.), SMUTS (JACQUES), & VAN NIEKERK (J. N.). *Quantitative analysis of Foscher-Tropsch catalysts by X-ray diffraction*. Anal. Chem., 1960, **32**, 20–24, 3 figs.

The crystalline components [α -iron, magnetite, pseudocementite (Fe_3C), Hägg carbide (Fe_2C), and Eckström-Adcock carbide (FeC)] have been analysed quantitatively by X-ray diffractometry. The estimated standard deviations were 3–10% of component concentrations, and the limits of detection vary from 1 to 5 wt. %. The methods used are generally applicable to the analysis of complex mixtures of crystalline solids.

D. A. M.

[KONOVALOV (P. F.) & ЕФРЕМОВ (A. I.)] Коновалов (П. Ф.) и Ефремов (А. И.). Применение ионизационного рентгеноструктурного анализа для изучения некоторых физико-химических процессов [*The application of ionization X-ray structural analysis to the study of certain physico-chemical processes*]. Труды пятого сов. эксп. техн. мин. petr. [Trans. fifth conf. exper. techn. min. petr.], Изд. Акад. Наук СССР. [Publ. Acad. Sci. U.S.S.R.], 1958, **146**–158, 8 figs.

The application of the ionization registration of X-ray radiation allows the study of processes at 1400°C and higher. It also simplifies the preparation of samples and greatly reduces the time of photographic exposure (20–30 minutes instead of 10–100 hours). The apparatus setting, which is described, allowed study of a number of polymorphic transformations, such as $\gamma\text{-2CaO.SiO}_2 \rightarrow 2\text{CaO.SiO}_2$, $\gamma\text{-Al}_2\text{O}_3 \rightarrow \alpha\text{-Al}_2\text{O}_3$. Also various hydrates and the process of dissociation of limestone and magnesite were studied by this method.

S. I. T.

CULLEN (T. J.). *Potassium pyrosulphate fusion technique. Determination of copper in mattes and slags by x-ray spectroscopy*. Anal. Chem., 1960, **32**, 516–517.

After fusion of the sample with potassium pyrosulphate at moderate temperature, the cooled melt is ground and briquetted to give a uniform surface for exposure to X-rays. Heterogeneity and matrix effects are overcome without the need for an internal standard. An average deviation of 0.09% from chemical analysis is reported on 10 samples containing copper over the range from 1.38% to 56.26%.

D. A. M.

BIBLIOGRAPHIES AND BOOK NOTICES

English-Russian Geological Dictionary, compiled by T. A. Sofiano, edited by I. D. Borneman, and others. State Publ. Office for Techn. Theor. Liter., Moscow, 1957, 525 pp. Price 17r.90k.

Russian-English Geological Dictionary, compiled by T. A. Sofiano, edited by A. P. Lebedev & V. E. Khain. Central Edit. Board Foreign Language Sci. Techn. Dictionaries. Fizmatgiz, Moscow, 1960, 559 pp. Price 18r.60k. (Old roubles), 1r.86k. (New roubles).

With the ever increasing output of geological literature from the Soviet Union, knowledge of the Russian language by English-speaking geologists becomes ever more necessary. For those who have a smattering of Russian a good dictionary of geological terms is a most valuable accessory. Madame T. A. Sofiano must be congratulated on compiling these two most important volumes. Each of them contains some 35,000 terms—geological, mining, civil engineering, and allied physical, chemical, and biological. Single

word terms naturally predominate, but there is also a great number of compound terms, such as 'grading factor' or 'nepheline basalt', as well as more complex phrases, like 'local magnetic disturbance' or 'vegetable theory of oil origin'.

It is perhaps to be expected that in the second dictionary (Russian-English) the arrangement is more systematic and consistent. The rule is that the principal term, e.g., 'crater', is entered alphabetically, the derived terms, e.g., 'crater bowl', 'crater dent', 'crater dome', etc., being entered under the principal term and indented for ease in tracing. In the English-Russian dictionary this rule, unfortunately, is not followed. To take parallel terms in the two volumes: 'faceted pebble' in the English-Russian volume is in the 'F' section and in the Russian-English volume it is under 'pebble' (gal'ka).

Although the inclusion of compound terms and longer phrases undoubtedly adds to the value of the work, there

are some phrases whose inclusion seems unnecessary, e.g., 'sediments of cosmic dust', 'sediments of cosmic origin', 'shield volcano basalt'. The majority of the terms, judging from a rapid perusal, are correctly translated, but there are also some mistranslations, e.g., 'U-shaped', translated as 'box-Shaped'; 'volcanic theory', translated most unexpectedly as 'the theory of volcanic origin of petroleum'.

At the end of the English-Russian dictionary there is glossary of English abbreviations and here strange and unexpected abbreviations appear, such as 'A (air course)—ventilation shaft', 'a. (arroyo)—dried ravine', 'm. (old measurement)', and so on, but we do not find 'e.g.', 'i.e.', and other common accepted signs. The Russian-English dictionary has no list of Russian abbreviations, which is a great pity for the Russian geological publications are full of mysterious combinations of letters indicating various institutions and periodicals. Who would guess, for example, that the letters VSEGEI stand for the Russian equivalent of 'Geological Survey'. Dictionaries of this type should be provided not only with a full list of common abbreviations, but also with a list of the respective weights, measures, and monetary values.

Both of these dictionaries are well-printed and well-bound and are of a handy size ($21 \times 14 \times 3$ cm). Ignoring all the minor defects noted above, one can assert that these two dictionaries are as good as one would wish for; they are the first of their kind, and as such will prove to be a great help to geologists.

S. I. T.

[ELISEEV (N. A.)] Елисеєв (Н. А.). *Метаморфизм* [*Metamorphism*]. Изд. Ленин. Унив. [Publ. Leningrad Univ.], 1959, 415 pp., 224 figs. Price 25r.35k.

This excellent text-book of metamorphism and metamorphic rocks is based on lectures given by the author in the University of Leningrad. Part I deals with metamorphic rocks; Part II with metamorphic and metasomatic processes. The scope of the whole volume can be judged by the following abbreviated chapter headings:—Part I: (1) General considerations, (2) Minerals, structures, and textures, (3) Cataclastic metamorphic rocks, (4) Thermal metamorphic rocks, (5) Dynamothermal metamorphic rocks, (6) Autometamorphic rocks, (7) Metasomatites, (8) Polymetamorphosed and retrogressively metamorphosed rocks. Part II: (9) Deformation of rocks, (10) Chemical equilibria in metamorphic processes, (11) Volatiles and their role in metamorphic and metasomatic processes, (12) Equilibrium diagrams, (13) Metamorphic facies, (14) Metasomatism, (15) Chemical kinetics and metamorphic differentiation, (16) Ultrametamorphism. The book contains a large number of photographs, line drawings, and diagrams. A compliment is paid to A. Harker by reproducing fifty figures, each containing usually two drawings

or rock sections, from his book 'Metamorphism', published in 1932. Harker's book as well as other recent books and articles on metamorphism are very skilfully used by the author in a modern, critical presentation of this subject both in its static and in its dynamic aspects, i.e., in the description of rocks and in the discussion of processes. Besides names familiar to English-speaking readers, there is frequent mention of such names as D. S. Korzhinsky, A. N. Zavaritzky, V. A. Nikolaev, N. I. Nakovnik, I. A. Ostrovsky, and A. A. Polkanov. The discussion of the work done by the Soviet workers and the integration of the results of their work with that done elsewhere add greatly to the value of this book. Without being critical of the substance of the book, one may point out that James Hutton was a Scottish, not an English scientist, and that the name of A. Harker should be included among the names of those responsible for the advancement of the modern science of metamorphism. There is a bibliography of eleven pages, but no index.

S. I. T.

[FRANK-KAMENETSKIĬ (V. A.), KONDRAT'eva (V. V.), & KAMENTSEV (I. E.)] Франк-Каменецкий (В. А.); Кондратьева (В. В.) и Каменцев (И. Е.). Руководство для лабораторных занятий по рентгеновскому исследованию минералов [*A manual for laboratory work on the X-ray study of minerals*]. Изд. Ленин. Унив. [Publ. Leningrad Univ.], 1959, 199 pp., 64 figs.

This mimeographed booklet contains a very full and very compact presentation of the apparatus, manipulation, and mathematical methods used in the X-ray analysis of minerals. Part I deals with the X-ray equipment and conditions of work; Part II with the powder method of X-ray analysis; Part III with the study of single crystals by means of the KRON-2 camera; Part IV with precision determination of parameters of the unit cell of polycrystals by means of the RKE camera.

S. I. T.

[LAZARENKO (E. K.)] Лазаренко (Е. К.). Курс Мінералогії. Частина II. Опис мінералів [*A text-book of mineralogy. Part II. Description of minerals*]. Вид. Львів. Унів. [Publ. Lvov Univ.], 1959, 654 pp., 60 figs., 30 portraits. Price 13r.40k.

This is the second volume of the projected three-volume textbook of mineralogy; the first volume was published in 1958 [M.A. 14-242]. Like Kostov [M.A. 13-121] the author has adopted an integral approach to each of the minerals described, that is, besides the usual chemical and physical characters of each mineral an account is provided of its fine structure, illustrated by very good diagrams, with thermal data if available, equilibrium diagrams, field occurrence, and paragenetic associations. In a number of cases very clear geological maps and sections illustrating

the field occurrence are provided. There are also a number of diagrams showing the relations between various properties of minerals. Thirty portraits of famous mineralogists ranging from Werner to Samoilov are appropriately placed among the photographs of minerals which they particularly enjoyed studying. The contents of this well-written book are very well arranged and attractively presented so that the book may be enjoyed by any one acquainted with the Ukrainian language. S. I. T.

PAFFENGOL'TS (K. N.) [Паффенгольц (К. Н.). Геологический очерк Кавказа [*Geological outline of the Caucasus*]. Изд. А. Н. Армянской ССР [Publ. Acad. Sci. Armenian S.S.R.], Erevan, 1959, 506 pp., 34 figs., 3 folding maps, and tables. Price 21r.60k.

This book, written by Paffenholz in collaboration with P. D. Gamkrelidze, G. M. Efremov, K. B. Miklukho-Maclay, A. N. Rodzyanko, and I. N. Safronov, presents a succinct account of the geology of the Caucasus. It comprises stratigraphy including the description of lavas and pyroclastic products, tectonics, metallogeny, and geomorphology. The appended bibliography (pp. 444–503) contains over 1000 titles, but the complete bibliography would be of the order of 5000 titles. This book is the first of its kind to provide a summary of the geology of the Caucasus, mainly based on material published during the present century. S. I. T.

TEISSEYRE (H.), SMULIKOWSKI (K.), & OBERC (J.). *Regionalna Geologia Polski. Sudety. Utwory Przedtrzęsiorzędowe* [Regional geology of Poland. Sudetes. Pretertiary formations]. Pol. Tow. Geol., Kraków, 1957, 3, 1–300, 43 figs., 23 pls., 12 tables, 19 maps.

This volume comprises stratigraphy, palaeogeography, sedimentology, petrology, metamorphism, and structural analysis of various regions of the Sudetes. It also deals with geological problems of the mountains and their relation to the kratogenic region of Czechoslovakia. 91 chemical analyses are given. W. S.

[ZARIDZE (G. M.) & TATRISHVILI (N. F.)] Заридзе (Г. М.) и Татришвили (Н. Ф.). Магматизм Грузии и связанные с ним рудообразования [*The magmatism of Georgia and the ore formations associated with it*]. Госгеолтехиздат [Gosgeoltekhnizdat], Moscow, 1959, 254 pp., 32 figs.

This book provides a very full and compact summary of a century of petrographical study of the igneous, metamorphic, and metasomatic rocks of Georgia (Western Transcaucasia). It contains seven chapters: (1) Brief notes on the tectonics of the Caucasus; (2) General outline of stratigraphy and magmatism of the Caucasus; (3) Pre-Mesozoic rocks of Georgia; (4) Pre-Mesozoic rocks of the territories bordering Georgia on the north; (5) Mesozoic-Kainozoic rocks of Georgia; (6) Certain problems of petrogenesis, as, for example, the problems of granitization, metasomatism, and the sequence of magmatic processes; (7) The connection between ore formation and mobile zones and intrusions. The appended bibliography (pp. 235–243) contains some 300 items. S. I. T.

TWENHOFEL (W. H.). *Principles of sedimentation*. 2nd edition. New York (McGraw-Hill), 1960, 673 pp., 83 figs. Price 85s. 6d.

R. A. H.

CLAY MINERALS

POMMER (A. M.). *Sodium-sensitive glass electrodes in clay titrations*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B502–504, 1 fig., 1 table. [M.A. 14–463]

K. S.

MAY (IRVING). *Preparation of stable gelatin-montmorillonite clay extrusions*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B163–164.

K. S.

SERRATOSA (J. M.). *Dehydration studies by infrared spectroscopy*. Amer. Min., 1960, **45**, 1101–1104, 4 figs.

Studies on montmorillonite from Tidinit, Morocco, and on nontronite from Utah show the structural OH stretching frequency at between 3600 and 3700 cm^{-1} . The greatest lower frequency difference between the two minerals was

an absorption feature at 915 cm^{-1} for montmorillonite, 820 cm^{-1} for nontronite. A doubtful feature occurs at 860 cm^{-1} for nontronite. These features appear to represent hydroxyls which have one Fe and one Al or Mg neighbour.

A. C. H.

TENSMAYER (L. G.), HOFFMAN (R. W.), & BRINDLEY (G. W.). *Infrared studies of some complexes between ketones and calcium montmorillonite*. Journ. Phys. Chem., 1960, **64**, 1655–1662, 6 figs.

W. T. H.

HIGHT (R., Jr.), HIGDON (W. T.), & SCHMIDT (T. W.). *Small angle X-ray scattering study of sodium montmorillonite clay suspension*. Journ. Chem. Phys., 1960, **33**, 1656–1661.

Centrifuged fractions of montmorillonite from Clayspur, Wyoming, were found by X-ray scattering to be platelets 9 Å thick and more than 500 Å diameter. W. T. H.

SCHNEPFER (MARIAN M.). *Cation exchange with vermiculite*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B161-163, 2 tables.

The ion exchange capacity of vermiculite [M.A. **10-462**] may make the mineral of use as a scavenger for caesium from radioactive wastes, but the saturation time of a vermiculite may range from one day to three weeks. The chemical analyses of eight vermiculites with the locality and the mineral composition, determined by X-ray diffraction, are given for each sample. K. S.

SHIMODA (SUSUMU) & SUDO (TOSHIO). *An interstratified mixture of mica clay minerals*. Amer. Min., 1960, **45**, 1069-1077, 1 fig., 3 tables.

A 26 Å clay mineral occurs at several places in Japan and was found pure as vein-shaped masses in pyrophyllite of the diaspore-pyrophyllite deposit in Yonago mine, Nagano Prefecture. X-ray data are given for the mineral at room temp. and dried at 300°, 500°, 700°, 900°, and 1000°C. D.t.a. curves are figured. Treatment with water or ethylene glycol gave no unique result. The chemical composition almost agrees with that of allevardite [M.A. **11-127**, 190] and is SiO₂ 43.17, Al₂O₃ 33.54, TiO₂ 0.51, Fe₂O₃ 0.26, FeO 0.13, CaO 0.52, MgO 0.65, K₂O 2.84, Na₂O 0.38, P₂O₅ tr., H₂O+ 10.48, H₂O- 7.75, =100.23. The 26 Å spacing is attributed to a complex combination of the 10 Å mica clay mineral structure and its more hydrated forms. A. C. H.

AMES (L. L., Jr.). *The cation sieve properties of clinoptilolite*. Amer. Min., 1960, **45**, 689-700, 12 figs.

Clinoptilolite was found to be highly selective over a wide pH, flow rate, and temperature range in removing caesium from aqueous solutions containing large amounts of competing cations. A. C. H.

HEFLIK (W.). *Petrografia szkliva wulkanicznego z ilów bentonitowych z miejscowosci Ciecierz koło Chmielnika* [Petrography of volcanic glass in bentonitic clays from Ciecierz near Chmielnik]. Kwart. Geol. [Warsaw], 1959, **3**, no. 4, 778-789, 2 figs., 4 tables, (English summary).

The chemical analysis of volcanic glasses isolated from the bentonitic clays gave: SiO₂ 60.04, Al₂O₃ 15.06, Fe₂O₃ 4.02, FeO 3.07, MgO 3.98, CaO 4.16, Na₂O 1.86, K₂O 2.03, H₂O 5.08, TiO₂ 0.09, P₂O₅ 0.17, MnO 0.86, =100.42.

W. S.

HONDA (SAKURO). *Differential thermal diagrams of bentonite treated with piperidine*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 131-134, 3 figs., 1 table, (Japanese with English summary).

Differential thermal analyses were made of six bentonites which were treated with piperidine. Specimens were selected on the basis of swelling capacity. It was found that the swelling bentonites gave an exothermic peak at about 600°C, but non-swelling bentonites at about 800°C. X-ray powder data of the six specimens are also presented.

I. S.

CALDER (A. B.). *Direct methods of estimation in the spectrographic analysis of cobalt in soil concentrates*. Nature, 1961, **189**, 165-166.

M. J. Le B.

KLINGE (HANS). *Die Böden El Salvadors, Zentralamerika*. Neues Jahr. Geol. Paläont., Monatshefte, 1960, 404-416, 2 tables.

The character and distribution of soil types in El Salvador are briefly described and conditions for their development considered. References are copious.

A. P.

HILL (D. E.) & TEDROW (J. C. F.). *Weathering and soil formation in the Arctic environment*. Amer. Journ. Sci., 1961, **259**, 84-101.

Clay mineral analysis of four Arctic Brown soil profiles from northern Alaska shows that slow chemical weathering and mechanical weathering are both significant processes of soil formation in well-drained areas on calcareous graywacke sandstone, on gabbro, on glacial till, and on a kame-terrace in the Arctic foothills in the vicinity of 68°30' to 69°00' N., and 152°10' to 156°15' W.

H. W.

SWINEFORD (ADA), editor. *Clays and Clay Minerals*. Proc. 6th Conf. Clays & Clay Minerals. Earth Science Monograph no. 2 (Pergamon Press, London), 1959, 411 pp., 144 figs., 88 tables. Price \$8.50.

Twenty-nine papers presented at this conference, held at the University of California, Berkeley, August 19-23 1957, include:—

KELLEY (F. R.), CLEVELAND (G. B.), & ARKLEY (R. J.). *Field trip to the Ione clay area held in conjunction with the Sixth National Clay Conference, August 21 1957*. 3 figs. (pp. 1-17).

BRADLEY (W. F.). *Current progress in silicate structures*. 6 figs. (pp. 18-25).

DE VORE (G. W.). *The surface chemistry of feldspars and an influence on their decomposition products*. 5 figs. (pp. 26-41).

- YODER (H. S., Jr.). *Experimental studies on micas: a synthesis*. 15 figs. (pp. 42–60).
- PREISINGER (ANTON). *X-ray study of the structure of sepiolite*. 3 figs. (pp. 61–67).
- GARRELS (R. M.) & HOWARD (PETER). *Reactions of feldspar and mica with water at low temperature and pressure*. 9 figs. (pp. 68–88).
- MEYER (CHARLES) & HEMLEY (JULIAN). *Hydrothermal alteration in some granodiorites*. 2 figs. (pp. 89–100).
- TAYLOR (H. F. W.). *The dehydration of tobermorite*. 3 figs. (pp. 101–109).
- BARSHAD (ISAAC). *Factors affecting clay formation*. 14 figs. (pp. 110–132).
- JACKSON (M. L.). *Frequency distribution of clay minerals in major great soil groups as related to the factors of soil formation*. (pp. 133–143.)
- HARRISON (J. L.) & MURRAY (H. H.). *Clay mineral stability and formation during weathering*. 5 figs. (pp. 144–153).
- WEAVER (C. E.). *The clay petrology of sediments*. (pp. 154–187.)
- SAND (L. B.) & BAUR (G. S.). *Genesis of kaolinite in Cretaceous shales of central Colorado*. (pp. 188–195.)
- VAN OLPHEN (H.). *Forces between suspended bentonite particles. Part II. Calcium bentonite*. 7 figs. (pp. 196–206).
- GRANDQUIST (W. T.). *Flow properties of dilute montmorillonite dispersions*. 6 figs. (pp. 207–219).
- KAHN (ALLAN). *Studies on the size and shape of clay particles in aqueous suspension*. 13 figs. (pp. 220–236).
- BATES (T. F.) & COMER (J. J.). *Further observations on the morphology of chrysotile and halloysite*. 9 figs. (pp. 237–248).
- JOHANSEN (R. T.) & DUNNING (H. N.). *Water-vapor sorption on clays*. 3 figs. (pp. 249–258).
- MARTIN (R. T.). *Water-vapor sorption on kaolinite: hysteresis*. 7 figs. (pp. 259–278).
- TAKAHASHI (HIROSHI). *Effect of dry grinding on kaolin minerals*. 12 figs. (pp. 279–291).
- GRANDQUIST (W. T.) & SUMNER (G. G.). *Acid dissolution of a Texas bentonite*. 5 figs. (pp. 292–308).
- POWERS (M. C.). *Adjustment of clays to chemical change and the concept of the equivalence level*. 3 figs. (pp. 309–326).
- BURST (J. F., Jr.). *Postdiagenetic clay mineral-environmental relationships in the Gulf Coast Eocene*. 10 figs. (pp. 327–341).
- BUNDY (W. M.) & MURRAY (H. H.). *Argillization in the Cochiti mining district, New Mexico*. 10 figs. (pp. 342–368).
- WEINTRAUB (JUDY) & SAND (L. B.). *Alteration of micaceous minerals by sulfide solutions*. 5 figs. (pp. 369–377).
- AMES (L. L.) & SAND (L. B.). *Halloysite formed in a calcareous hot spring environment*. 6 figs. (pp. 378–385).
- EHLMANN (A. J.) & SAND (L. B.). *Occurrences of shales partially altered to pyrophyllite*. 6 figs. (pp. 386–391).
- SAND (L. B.) & AMES (L. L.). *Stability and decomposition products of hectorite*. 1 fig. (pp. 392–398).
- LOPEZ-GONZALES (J. DE D.) & CANO-RUIZ (J.). *Surface area changes of a vermiculite by acid and thermal treatment*. 3 figs. (pp. 399–405).
- D. C.
- SWINEFORD (ADA), editor. *Clays and Clay Minerals*. Proc. 5th Conf. Clays & Clay Mins., Nat. Acad. Sci., Nat. Res. Council, Washington, 1958, Publ. 566, 360 pp., 146 figs., 55 tables. Price \$4.50.
- Twenty-seven papers presented at this conference, held at the University of Illinois, Urbana, October 8–10, 1956, include:—
- LANGSTON (R. B.) & PASK (J. A.). *Analysis of consistencies of kaolin-water systems below the plastic range*. 8 figs. (pp. 4–22).
- MARTIN (R. T.). *Water vapor sorption on lithium kaolinite*. 9 figs. (pp. 23–38).
- SAND (L. B.) & AMES (L. L., Jr.). *Altered siliceous volcanics as a source of refractory clay*. 5 figs. (pp. 39–45).
- OAKES (D. T.). *Filtration theory for oil-well drilling fluids*. 9 figs. (pp. 46–60).
- VAN OLPHEN (H.) & WAXMAN (M. H.). *Surface conductance of sodium bentonite in water*. 5 figs. (pp. 61–80).
- WHITEHOUSE (U. G.) & McCARTER (R. S.). *Diagenetic modification of clay mineral types in artificial sea water*. 14 figs. (pp. 81–119).
- KELLER (W. D.). *Glaucconitic mica in the Morrison formation in Colorado*. 1 fig. (pp. 120–128).
- PUNDSACK (F. L.). *Density and structure of endellite [halloysite]*. (pp. 129–135.)
- MUMPTON (F. A.) & ROY (RUSTUM). *New data on sepiolite and attapulgite [palygorskite]*. 1 fig. (pp. 136–143).
- KULBICKI (GEORGES). *High temperature phases in montmorillonites*. 11 figs. (pp. 148–158).

- WEAVER (C. E.). *A discussion on the origin of clay minerals in sedimentary rocks*. 4 figs. (pp. 159–173).
- KORNFELD (J. A.). *Statistical relationships of minor constituents of some nontronites*. 7 figs. (pp. 174–188).
- SHEELER (J. B.), HANDY (R. L.), & DAVIDSON (D. T.). *Effects of a synthetic resin on differential thermal analysis of loess*. 7 figs. (pp. 189–196).
- GAREY (C. L.). *Clay mineral distribution in the soil areas of Arkansas*. (pp. 197–202.)
- RICH (C. I.). *Muscovite weathering in a soil developed in the Virginia Piedmont*. 6 figs. (pp. 203–212).
- BROWN (B. E.) & JACKSON (M. L.). *Clay mineral distribution in the Hiawatha sandy soils of northern Wisconsin*. 6 figs. (pp. 213–226).
- GLASS (H. D.). *Clay mineralogy of Pennsylvanian sediments in southern Illinois*. 6 figs. (pp. 227–241).
- DALTON (JANE A.), SWINEFORD (ADA), & JEWETT (J. M.). *Clay minerals at a Pennsylvanian disconformity*. 7 figs. (pp. 242–252).
- MILNE (I. H.) & SHOTT (W. L.). *Clay mineralogy of Recent sediments from the Mississippi Sound area*. 8 figs. (pp. 253–265).

- BRINDLEY (G. W.) & NAKAHIRA (M.). *A kinetic study of the dehydroxylation of kaolinite*. 6 figs. (pp. 266–278).
- MCATEE (J. L., Jr.). *Heterogeneity in montmorillonite*. 6 figs. (pp. 279–288).
- WHITE (J. L.). *Layer charge and interlamellar expansion in a muscovite*. 2 figs. (pp. 289–294).
- JONAS (E. C.). *Experimental structure factor curves of montmorillonites*. 7 figs. (pp. 295–307).
- MCATEE (J. L., Jr.). *Random interstratification in organophilic bentonites*. 5 figs. (pp. 308–317).
- KINTER (E. B.) & DIAMOND (SIDNEY). *Gravimetric determination of monolayer glycerol complexes of clay minerals*. 5 figs. (pp. 318–333).
- DIAMOND (SIDNEY) & KINTER (E. B.). *Surface areas of clay minerals as derived from measurement of glycerol retention*. 2 figs. (pp. 334–347).
- BRADLEY (W. F.), ROWLAND (R. A.), WEISS (E. J.), & WEAVER (C. E.). *Temperature stabilities of montmorillonite- and vermiculite-glycol complexes*. 9 figs. (pp. 348–355).

D. C.

CRYSTAL STRUCTURE OF MINERALS

- ITAKA (YOICHI) & SAKURAI (TOSHIO). *The crystallographic calculation by the parametron computer P.C.I.* Journ. Min. Soc., Japan, 1960, **4**, 409–434, 3 tables, 8 figs., (in Japanese).

Use of the parametron computer P.C.I for crystallographic calculation is described. Programmes have been devised for the corrections of Lorentz-polarization factors, the transform between direct and reciprocal lattices, and the calculation of Q-values, 2θ and $\sin\theta/\lambda$. The computer can be used extensively for calculations needed in the determination and refinement of crystal structures, i.e., programmes are given for the calculation of structure factors, the computation of two-dimensional Fourier synthesis, the correction for temperature factors, the computation of differential Fourier synthesis, least squares, and molecular transform, and for the calculation of atomic distances. These programmes are listed in a table.

M. S. J.

- [BELOV (N. V.)] БЕЛОВ (Н. В.). X. Очерки по структурной минералогии [X. *Essays on structural mineralogy*]. Мин сборник Львов. геол. общ. [Min. Mag. Lvov Geol. Soc.], 1959, **13**, 23–52, 23 figs.

The importance of large cations (Ca, Na, Li, K) in silicate structures is examined. These cations are octa-

hedrally co-ordinated and the octahedral edges are of a similar length to the vertical edge of the trigonal prisms of the Si_2O_7 group. It is suggested that on alteration minerals with the large cations change into minerals with alternate octagonal and tetragonal rings (e.g., apophyllite), or octagonal and pentagonal rings (e.g., okenite), or hexagonal and tetragonal rings (e.g., tobermorite), whereas minerals with smaller cations (Fe, Mg, Al) alter into minerals with uniform hexagonal motif such as micas and chlorites.

N. R.

- BENSON (G. C.), BALK (P.), & WHITE (P.). *Contribution of surface distortion to the surface energy of alkali halide crystals*. Journ. Chem. Phys., 1959, **31**, 109–115, 8 figs., 8 tables.
- BENSON (G. C.), DEMPSEY (E.), & BALK (P.). *Distortion correction to the surface energy of the {110} face of alkali halide crystals*. Journ. Chem. Phys., 1961, **34**, 157–162.

Theoretical calculations indicate that the surface energy of an ideal NaCl crystal is reduced about 30% by dipole distortion at the surface, for faces of either the {110} or the {100} form. To make the theoretical surface energy agree with measured values it would be necessary to have about 75% of the surface in the {110} form. W. T. H.

PERSON (J. H.) & WEIL (J. A.). *Paramagnetic resonance of color centers in germanium-doped quartz*. Journ. Chem. Phys., 1959, **31**, 426-434, 6 figs.

Two spin resonance lines are associated with a 4.5 eV optical absorption band in germanium-doped synthetic quartz. The detailed interpretation involves a trapped electron at the Ge atom in an Si site, and a neighbouring Li-Na interstitial atom. W. T. H.

K (H. L., Jr.) & WILLIAMS (D.). *Zeeman splitting of nuclear quadrupole levels in cuprite*. Journ. Chem. Phys., 1960, **32**, 633-634.

Asymmetry of the Cu sites in the field of the two neighbouring O atoms was too low to be measurable. W. T. H.

ANNINGTON (P. S.) & PETCH (H. E.). *Nuclear magnetic resonance spectrum of B^{11} in inderite*. Journ. Chem. Phys., 1960, **33**, 329-334, 5 figs.

Quadrupolar splitting of the B^{11} nuclear magnetic resonance signal in inderite (Kramer District, California) interpreted on the basis that 3 types of sites, two tetrahedral and one triangular, are related by a centre of symmetry; the space group is $P1$. Electric quadrupole coupling constants and asymmetry parameters are given. W. T. H.

KUCHI (C.) & MATARRESI (L. M.). *Paramagnetic resonance absorption of ions with spin 5/2: Mn^{++} in calcite*. Journ. Chem. Phys., 1960, **33**, 601-606, 8 figs.

Double splitting of the fine-structure lines is quantitatively accounted for by the presence of Mn^{2+} in the two nonequivalent Ca^{2+} sites. W. T. H.

MATARRESI (L. M.). *Comments on the EPR spectrum of Mn^{++} in calcites*. Journ. Chem. Phys., 1961, **34**, 336. Further theoretical discussions [preceding abstract]. W. T. H.

CALL (D. W.) & DOUGLASS (D. C.). *Nuclear magnetic resonance in solid adamantane*. Journ. Chem. Phys., 1960, **33**, 777-778, 2 figs.

Adamantane, $C_{10}H_{16}$, specimen supplied by P. von R. Schleyer [Journ. Amer. Chem. Soc., 1957, **79**, 3292], undergoes a rotational transition at about $-120^{\circ}C$. W. T. H.

LIOTT (M.). *Interatomic distances in FeS_2 , CoS_2 , and NiS_2* . Journ. Chem. Phys., 1960, **33**, 903-905, 1 fig.

Pyrite, cattierite, and vaesite were studied by powder diffraction, giving a 5.404, 5.523, and 5.677 Å respectively. Position parameters for S were calculated from intensities, and the S-S bond length is consistent either with a neutral

molecule or an S_2^{2-} ion. Variations of the M-S bond length depend on the number of anti-bonding electrons shared with the metal ions. W. T. H.

FRIEDLAND (E.) & LOW (W.). *Effect of thermal treatment of paramagnetic resonance spectra of rare earth impurities in calcium fluoride*. Journ. Chem. Phys., 1960, **33**, 1275-1276.

Rare earth ions such as Gd^{3+} can be equilibrated in sites of cubic point symmetry by slow cooling from $1200^{\circ}C$, or maintained in axially symmetric sites by quenching, with a consequent change in the paramagnetic resonance spectra. W. T. H.

MCGRATH (J. W.) & SILVITI (A. A.). *Structure of the water molecule in solid hydrated compounds*. Journ. Chem. Phys., 1961, **34**, 322-325.

Proton separation in crystal water of 10 inorganic compounds (including gypsum) was measured, with the result $1.595 \pm 0.003 \text{ \AA}$ for all. Structure and dimensions of the water molecule are not affected by atomic environment. The water molecule is oriented so as to form hydrogen bonds with the nearest electro-negative atoms, while at the same time being able to present its negative pole toward the nearest positive ion. W. T. H.

FOSTER (MARGARET D.). *Correlation of dioctahedral potassium micas on the basis of their charge relations*. Bull. U.S. Geol. Survey, 1956, **1036-D**, 57-67.

In formulas derived from analyses of many varieties of dioctahedral potassium micas the number of Si ions in the tetrahedral group lies between three and four. Such micas are all members of a trisilicic-tetrasilicic series like that suggested by Schaller [M.M. 29-406] to interpret the composition of high silica sericites $KAlAl(Si_3Al)O_{10}(OH)_2$ - $KAlMg(Si_4O_{10})(OH)_2$. Generalization of these formulas by substitution of the symbols R^{3+} and R^{2+} for Al and Mg permits extension of this series to interpret the composition of dioctahedral potassium micas containing other cations than Al and Mg, such as Fe^{3+} and Fe^{2+} , V, Cr, and Mn. From the trisilicic to the tetrasilicic end-members there is a shift in the seat of the charge from the tetrahedral to the octahedral group. In intermediate members of the series the charge is due partly to replacement of aluminium for silicon in the tetrahedral group and partly to replacement of bivalent for trivalent ions in the octahedral group. This tetrahedral-octahedral charge relationship is suggested as a basis for the classification and correlation of the dioctahedral potassium micas. K. S.

FOSTER (MARGARET D.). *Interpretation of the composition of trioctahedral micas*. Prof. Paper U.S. Geol. Survey, 1960, **354-B**, 11-49.

Structural formulas calculated for more than 200 published analyses of phlogopite, biotite, siderophyllite, and lepidomelane indicate that the additional positive charges carried by trivalent cations proxying for bivalent Mg in the octahedral group of trioctahedral micas are accommodated in two different ways: (1) by a positive charge on the octahedral layer, which is neutralized by an equivalent increase in the negative tetrahedral charge (increased replacement of Si by Al), and all the octahedral sites are occupied; or (2) are neutralized by negative charges associated with unoccupied octahedral sites. The trioctahedral micas can be considered members of a complete system, at one end of which is phlogopite, with essentially complete octahedral occupancy by Mg, and at the other end siderophyllite and lepidomelane, with essentially no octahedral Mg. Biotites from different igneous rocks may be very similar in composition; on the other hand, biotites from the same rock-type may differ greatly in composition. Micas at the extreme ends of the trioctahedral replacement system, phlogopites and siderophyllites-lepidomelanes occur in more extreme types of rocks, phlogopite in ultrabasic igneous rocks, metamorphosed limestone, and contact-altered rocks, and the Mg-free micas in pegmatites and greisen. 'Eastonite' (Winchell 1925) should be discarded in reference to a natural trioctahedral mica and retained only as a hypothetical end-member. Annite (Dana 1868), a high Fe^{3+} biotite, was assigned by Winchell [M.A. 3-12] to a hypothetical Fe^{2+} analogue of phlogopite, a component of biotite. The author found a complete absence of Fe^{2+} -dominant micas analogous to phlogopite and therefore recommends 'that annite be discarded as referring to a natural trioctahedral mica, and retained only as a hypothetical end member'.

K. S.

SHIROZU (HARUO). *Ionic substitution in iron-magnesium chlorites*. Mem. Fac. Sci., Kyushu Univ., ser. D, 1960, **9**, 183-186, 1 fig.

Studies of the chemical composition of well-crystallized chlorites of the iron-magnesium series showed—(1), that substitution of Al^{3+} for Si^{4+} (and Mg^{2+} or Fe^{3+}) is limited to a rather narrow range, and in general in the series magnesium chlorites to iron chlorites the aluminium content is greater in the latter than in the former; (2), that the number of Al in the four tetrahedral (Si, Al) sites ranges from 1.0 to 1.3 for nearly all magnesium chlorites, and from 1.3 to 1.5 for iron chlorites. These results are discussed from the view point of structural chemistry.

M. S. J.

LIEBAU (F.). *Zur Kristallchemie der Silikate, Germanate und Fluoberyllate des Formeltypus ABX_3* . Neues Jahrb. Min., Abhandl., 1960, **94**, 1209-1222, 1 fig.

The lattice constants and structure types have been

determined for SrSiO_3 , BaSiO_3 , CaGeO_3 , SrGeO_3 , BaGeO_3 , KBeF_3 , and CsBeF_3 . The alkaline earth silicates form the two isomorphotropic series with the structure types pyroxene-wollastonite-pseudowollastonite- BaSiO_3 . Rhodnite and pyroxmangite form different structure types with 5 and 7 tetrahedra repeat units respectively. CuGeO_3 is an example of a structure with one tetrahedron repeat unit. Thus the kind of anion of a compound depends not only on the cation size and charge but also on its electronic configuration. [M.A. 13-13, 14-253, 254, 332] R. A. H.

PISTORIUS (CARL W. F. T.). *Lattice constants and probable space group of anhydrous cupric sulfate (artificial chalcocyanite)*. Amer. Min., 1960, **45**, 744-746.

X-ray data showed an orthorhombic lattice with unit cell a 8.391, b 6.811, c 4.791 Å, and space group $Pnma$.

A. C. H.

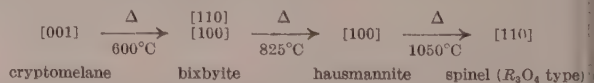
WUENSCH (BERNHARDT J.). *The crystallography of mag-governite, a complex arsenosilicate*. Amer. Min., 1960, **45**, 937-945, 3 figs.

Macgovernite was studied by the X-ray diffraction oscillation method. It was found to have the large unit cell, a 8.22, c 205.5 Å, yet discovered for an inorganic material which is not a stacking polytype. The space group is probably $R\bar{3}2/c$. From previous analyses and data from this study the rhombohedral cell content is $6[\text{Mn}_9\text{Mg}_4\text{Zn}_2\text{As}_2\text{Si}_2\text{O}_{17}(\text{OH})_{14}]$. The unit cell of mag-governite bears a close relationship to that of dixerite.

A. C. H.

FAULRING (G. M.), ZWICKER (W. K.), & FORGENG (W. D.). *Thermal transformations and properties of cryptomelane*. Amer. Min., 1960, **45**, 946-959, 7 figs.

The X-ray powder examination of a sample of cryptomelane from western Australia showed that the acicular crystals could be indexed in terms of a body-centred tetragonal unit cell. The following relative orientations parallel to the [001] axis and thermal transformations were found for cryptomelane.



The fibrous cryptomelane does not completely transform to bixbyite before the formation of hausmannite begins. Microanalysis gave MnO_2 84.2, MnO 3.3, CuO 0.08, CoO 0.1, MgO 0.08, BaO 0.08, CaO 0.05, Na_2O 0.38, K_2O 4.4, Al_2O_3 0.77, Fe_2O_3 1.86, SiO_2 0.30, = 95.6, indicating the formula $(\text{K},\text{Na})_{0.8}(\text{Mn}^{4+},\text{Mn}^{3+},\text{Fe}^{3+})_{8.0}\text{O}_{16}$.

A. C. H.

CLARK (JOAN R.). *X-ray crystallography of larderellite $\text{NH}_4\text{B}_5\text{O}_6(\text{OH})_4$* . Amer. Min., 1960, **45**, 1087-1094, 4 tables.

larderellite from Larderello, Italy, was found to have crystallographic values, a 11.63 ± 0.03 , b $7.61_5 \pm 0.02$, c $4.47 \pm 0.03 \text{ \AA}$, β $96^\circ 45' \pm 10'$, cell volume 830.9 \AA^3 ; space group $P2_1/a$, cell contents $2[(\text{NH}_4)_2\text{O} \cdot 0.5\text{B}_2\text{O}_3 \cdot 4\text{H}_2\text{O}]$, D (calc.) 8 g cm^{-3} , D (obs.) 1.905 ± 0.004 . Corresponding values obtained by MARINELLO (G.) [Atti Soc. Tosc. Sci. Nat., A., 1959, **66**, 257–272] are listed. X-ray powder data indexed. A. C. H.

GRADA (K.) & CAGLE (F. WM., Jr.). *The crystal structure of potarite (PdHg) with some comments on allopalladium*. Amer. Min., 1960, **45**, 1093–1097, 2 tables.

Indexed X-ray data are listed for natural potarite, for synthesized PdHg (details of preparation are given), and the mineral after annealing for 6 hours at 100°C in a sealed Lindemann capillary. The patterns are indexed for a body-centred tetragonal cell with a 3.020_5 , c 3.706_7 \AA , and content PdHg; the space group is $P4/mmm$. [M.M. **397**; M.A. **9**–223] A. C. H.

SSAU (K.). *Crystallographic angles of calcium tungstate (scheelite)*. Trans. Metall. Soc., A.I.M.E., 1960, **218**, 959–960, 1 fig.

A stereographic projection is presented for this tetragonal mineral whose $c/a = 2.169$. Data are given for angles between crystallographic planes in scheelite. R. G. Wls.

EBER (W.). *Über Hypermorphie*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1060–1074, 1 fig.

Hypermorphie relates to the discrepancy between morphological and structural symmetry which has the sequence of an increase in external symmetry. Examples mined include childrenite, barytocalcite, and petalite, in which the space group has no inversion centre whereas the morphology appears to be centrosymmetrical. A possible interpretation is based on kinetic growth considerations. R. A. H.

TAGAWA (ICHIRO). *Mechanism of crystal growth, etching and twin formation of hematite*. Min. Journ. (Japan), 1960, **3**, 59–89, 10 figs., 14 pls.

The surface structures of hematite crystals from nine localities were observed with an ordinary reflecting and a phase contrast microscope, and the step heights of growth surfaces as well as the other surface features were measured precisely by the multiple-beam interferometric method and the method of fringes of equal chromatic order. On the basis of these observations and measurements, the mechanism of crystal growth, natural etching, twin formation and movement of screw dislocations after cessation of growth, and the possibility of polytypism are discussed in this paper. A discussion is made in terms of unit cell or minimum

constitution of the unit cell. The physical and chemical conditions under which hematite crystals have grown are also discussed on the basis of the characteristics of growth and etch patterns. The author presents in this paper: (1) the whole process and mechanism of crystal growth, special attention being paid to the role of screw dislocations, their movement and concentration during growth; (2) confirmation that the minimum unit of growth is not one unit cell, but the height of the minimum constituent layer in the unit cell; (3) the discovery that screw dislocations can move after cessation of growth, and that a close relation exists between the amount of movement and the stress history of the crystal; (4) prediction of the possibility of polytypism in hematite; (5) a new interpretation is given for the mechanism of etching which was found to be two-dimensional rather than three-dimensional; (6) observations of characteristic surface structures at the contact twin boundaries and a new interpretation for the mechanism of twin formation; (7) observation, for the first time, of twinning due to stacking fault during growth and its structural interpretation. S. I. T.

KATO (KENJIRO). *Crystal form and unit cell constant of hematite from Sennin mine, Iwate Prefecture*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1958, **42**, 177–183, 2 figs., 2 tables, (in Japanese).

The crystal morphology of hematite from Sennin mine is described. The unit cell constants of the crystal by X-ray diffraction data are a 5.432 \AA , α $55^\circ 06'$. I. S.

NEFF (H.) & PAULITSCH (P.). *Röntgenographische Bestimmung der Hämatitregel in natürlichen Gefügen*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1401–1410, 6 figs.

The fabric of hematite in hematite-rich rocks has been investigated by X-ray methods. The prisms $10\bar{1}0$ and $11\bar{2}0$, the basal plane 0001 , and the rhombohedron $10\bar{1}4$ show preferred orientation in occurrences from the Harz, Spain, and Brazil. The character of lineation is L parallel with B. R. A. H.

[МОКІЕВСКІЙ (V. A.)] Мокиевский (B. A.). Влияние внешних условий на форму роста кристаллов [*The influence of external conditions on the growing shape of crystals*]. Кристаллография, Вып. 4, Изд. Ленин. Горн. Инст. [Crystallography, No. 4, Publ. Len. Mining Inst.], 1955, pp. 3–46, 26 figs.

Experiments with epsomite and alums were carried out in order to observe the changes in the morphological features produced by concentration currents, by the movement of the mother liquid as a whole, by its supersaturation, by change in its temperature, and by various admixtures introduced into it. Previous work on this subject, especially that published in Russia, is discussed and a bibliography of 96 items is provided. S. I. T.

HALDÉN (G. H.). *Quasi-cleavable quartz*. Rocks and Minerals, 1955, **30**, 38–39.

A description is given of massive colourless quartz, from Plumas County, California, which breaks parallel to rhombohedral faces. Cleavage of quartz is briefly discussed. R. S. M.

JACCODINE (R. J.) & KLINE (R. K.). *Whisker growth from quartz*. Nature, 1961, **189**, 298, 1 fig.

M. J. Le B.

HERITSCH (HAYMO). *Die äussere Gestalt kristallographischer Verwilligungen in Gruppendarstellung*. Tscherma Min. Petr. Mitt., 1960, ser. 3, **7**, 246–259.

A method is described for deriving the morphological symmetry of contact and penetration twins from the matrix expressions for the point group of the individual crystals and of the twin operation. The method is applied to about 20 well-known examples of twins and to several of multi-twins. [M.A. 14-473] A. P.

ECONOMIC MINERALS AND ORE DEPOSITS

General

WILLIAMS (D.). *Progress in mining geology: training, research and employment*. Trans. Inst. Mining & Metall., 1960, **69**, 587–602.

A Presidential Address pleading for the more liberal encouragement and use of geology by the mining industry. R. A. H.

EIGELES (M. A.). *Interaction between fatty acid soaps and certain oxides and silicates in the presence of activators*. Trans. Inst. Mining & Metall., 1960, **69**, 627–636, 4 figs.

Based on experimental studies of the interactions of quartz, feldspar, ilmenite, magnetite, chlorite, corundum, cassiterite, and zircon with fatty acids, the laws governing the fixation of the collector have been established. Colloidal iron hydroxide hydrosols as well as cations have an activating effect on quartz and feldspar. R. A. H.

GRAY (I.) & MILLMAN (A. P.). *Spectral reflectivity of ore minerals*. Nature, 1960, **188**, 1100.

Terms used in an earlier paper [M.A. 15-48] are clarified. M. J. Le B.

ROY (R.), MAJUMDAR (A. J.), & HULBE (C. W.). *The Ag_2S and Ag_2Se transitions as geologic thermometers*. Econ. Geol., 1959, **54**, 1278–1280, 2 tables.

The transitions argentite–acanthite (Ag_2S) and high–low naumannite (Ag_2Se) are useful indicators of certain minimum temperatures since their respective inversion temperatures, 176°C and 128°C, are raised less than 10°C by an increase of 1000 atmospheres of pressure. J. T. W.

ELLIS (A. J.). *The solubility of zinc sulphide in water at high temperatures*. Econ. Geol., 1959, **54**, 1035–1039, 4 tables.

The solubility of natural crystals of blende in pure

water is less than 5×10^{-6} mole/kg in the temperature range 200–300°C. Comparison of experimentally determined solubilities with those calculated from thermodynamic data suggests that thiosulfate complexes of heavy metals may be important agents in the transport of metal sulphides, since many heavy metals form soluble complex thiosulfates, for example, $Ag(S_2O_3)^-$ and $Ag(S_2O_3)_2^{3-}$. G. S. C.

BARNES (H. L.). *The effect of metamorphism on metal distribution near base metal deposits*. Econ. Geol., 1960, **54**, 919–943, 11 figs., 5 tables.

Quantitative estimation of Zn, Cu, and Fe contents of sedimentary rocks near ore deposits of the Hanover district, New Mexico, the northern Mississippi Valley district, and the San Francisco del Oro district, Mexico, indicates that the total metal content of the deposits could not have been concentrated through a process of lateral secretion from the surrounding sedimentary rocks. W. E. H.

OHLE (ERNEST L.). *Some considerations in determining the origin of ore deposits of the Mississippi Valley type*. Econ. Geol., 1959, **54**, 769–789.

A review of new data relating to the 'Mississippi Valley Type' deposits in North America, Europe, and Africa published in the period 1939–1957 supports the conclusion that such deposits have a common origin. A hypothesis proposed for the origin of an individual deposit may be proved applicable when this type of deposit is considered on a world-wide basis. The hypothesis that deposition is related to igneous activity has fewer limitations than the other two major hypotheses considered for the origin of these deposits. However, evidence is still inconclusive. W. E. H.

JUSKOWIAK (O.). *Poszukiwania złóż metali rzadkich metodą szlachową we wschodnim obrzeżeniu masywu Karkonoskiego* [Prospecting for deposits of rare metals using mineralogical method in the eastern border of Karkonosze massif]. Kwart. Geol. [Warsaw], 1959, **7**, 767–777, 1 fig., 2 tables (English summary).

Preliminary prospecting for ore deposits has been carried out in the eastern border of the Karkonosze massif [Riesengebirge] on the basis of quantitative mineralogical analyses of the river samples and examination of thin sections of their outcrops. Several paragenetic groups which characterize the metamorphic series as well as zones of contact and dynamic metamorphism have been distinguished. W. S.

ABDULLAEV (KH. M.) Абдуллаев (Х. М.). Магматизм и оруденение Средней Азии [Magmatism and ore mineralization in Central Asia]. Изд. Акад. Наук Узб. ССР [Publ. Acad. Sci. Uzbek S.S.R.], 1960, 147 pp., 18 tables, 2 folding maps (English summary pp. 115-124). Price 17r.70k. (old roubles), 1r.77k. (new roubles).

This is a detailed summary of the progress made, during the last few decades, in the study of magmatic rocks and ore deposits in Central Asia. As attempt is made to co-ordinate geology, magmatism, tectonics, and mineralization. This combined approach suggests the division of all Central Asia into four main zones. The northern zone is characterized by dominant Caledonian tectogenesis and magmatism; the other zones—central, western, and southern—by dominant Hercynian tectogenesis and magmatism, on which in places are superimposed Mesozoic and Alpine tectogenesis and magmatism. Thus, in Central Asia polygenetic magmatism and metallogeny is a common phenomenon. The principal ore deposits are associated with granitic zones. Contact metamorphism, assimilation, hybridism and late magmatic processes are the main factors in the formation of pegmatitic, hydrothermal, and skarn ores. Two types of skarn ores are the magnetite and the scheelite skarns. Only in western Uzbekistan are the high temperature cassiterite ores developed. Sulphide minerals (Fe, Cu, Pb, Zn compounds) are found in most of the skarn deposits. In the Kuramin ridge polymetallic and fluorite deposits are found; in the Alai and Zeravshan ranges mercury-antimony, and in Zeravshan pyritic skarns. Two genetic series of magmatic zones are distinguished: (1) granite-alaskite with associated pegmatite and greisen ores, (2) diorite-granodiorite-granite with associated skarn ores, and porphyry ores. The mercury-antimony and the fluorite ores of Alai ridge may be related to the alkali syenites, although some geologists link them with ultrabasic rocks. At the end of the book there is a bibliography of some 200 items, but there is no index. S. I. T.

Non-metallic minerals

ENKATARAMAN (K.). *Petrology of the Majgawan agglomeratic tuff and the associated rocks*. Quart. Journ. Geol. Min. Met. Soc. India, 1960, **32**, 1-10, 4 figs.

The Majgawan ultramafic diamondiferous pipe rocks are

described. They are considered younger than the associated Vindhyan sandstones and it is suggested that they may be related to the Deccan traps. A. P. S.

BOSE (DILIPKUMAR). *Graphite deposits around Polpol, Palamau District, Bihar*. Quart. Journ. Geol. Min. Met. Soc. India, 1959, **31**, 235-38, 2 figs.

Occurrences of graphite as veins in pegmatite bodies, fissure fillings in quartzites, and disseminations in paragneisses are described. Formation of the graphite veins is attributed to high grade metamorphism with impregnation of granite. A. P. S.

BOSAZZA (V. L.). *The non-radioactive minerals of the Tambane district, Nyasaland*. Mining Mag., 1960, **103**, 78-86, 5 figs.

The chief non-radioactive minerals of this area in south-west Nyasaland [M.A. 14-440] are brown and blue corundum, columbite, ilmenite, magnetite, pyrite, and molybdenite. The corundum-bearing rocks are thought to represent metamorphosed sediments. Analyses are given of a corundum-bearing rock and of a magnetite, and partial analyses include those of several columbites and other niobium-bearing opaque minerals. R. A. H.

MATHAD (G. G.) & ALTEKAR (V. A.). *Determination of alumina minerals in Kolhapur bauxite and its suitability for Bayer's Process*. Sci. & Culture, 1960, **25**, 695-697.

The procedures to determine Al_2O_3 as gibbsite, boehmite, and diaspore (after Masletinskii and Shmanenkov) in the bauxites are described. The bauxite of Kolhapur is predominantly gibbsitic. A. P. S.

CHOWDHURY (M. K. ROY). *Bauxite in Bihar, Madhya Pradesh, Vindhya Pradesh, Madhya Bharat, and Bhopal*. Mem. Geol. Surv. India, 1958, **85**, 271 pp., 3 figs., 7 pls.

A general review of some Indian occurrences of bauxite. A. P. S.

[LUKANINA (M. I.)] Луканина (М. И.). Минералогический состав руд Соколовского и Одинского месторождений Каменского района (Средний Урал) [The mineralogical composition of ores of Sokolovsky and Odinsky deposits of Kamensky region (Middle Urals)]. Mat. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-dep., Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, 311-348, 11 figs.

Supported by chemical, thermal, or X-ray data the following minerals of the Uralian bauxite deposits are described: pyrite, corundum, hematite, ilmenite, magnetite,

hydrargillite [gibbsite], goethite, hydrogoethite, quartz, calcite, chalybite, baryte, svanbergite, margarite. The structure and the genetic history of bauxite are discussed.

S. I. T.

KISKYRAS (D.). *Die mineralogische Zusammensetzung der griechischen Bauxite in Abhängigkeit von der Tektonik.* Neues Jahrb. Min., Abhandl., 1960, **94**, 662-680, 5 figs.

Greek bauxite deposits show a relatively high diaspore content and have a relatively low ore dressing solubility. The results of 156 analyses of bauxites from the Parnassus-Oeta, Euboea, Eleusis, and Ghiona Mountains areas are tabulated.

R. A. H.

HOSE (H. R.). *The genesis of bauxites, the ores of aluminium.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **16**, 237-247.

The specialized conditions necessary for the formation of bauxite include a tropical or sub-tropical climate with an adequate but seasonal rainfall on peneplains or plateaux underlain by rocks which because of their texture, structure, and composition weather to alumina hydrates instead of other residual minerals. Bauxites are grouped according to their formation: (1) from various rock types on peneplains, (2) on dissected volcanic domes and plateaux, (3) from limestones on karst plateaux, and (4) as sedimentary reworked bauxite deposits. The chemical derivations of bauxites are discussed with the aid of 24 rock analyses of igneous rocks, limestones, and their residual clays. [M.A. **11-49**, **12-116**]

R. A. H.

ALLEN (V. T.). *Comparison of bauxite deposits of Europe with those in the U.S.A.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **16**, 230-236.

The occurrences of bauxite and laterite in France, Yugoslavia, Greece, Italy, Spain, Germany, and Northern Ireland [M.A. **12-159**] are reviewed. Clays and alumina hydrates transported from suitable source areas were deposited in cavities prepared by solution: magnesium bicarbonate carried by groundwater removed silica from clay to form such alumina hydrate minerals. Observations in Georgia, Alabama, Arkansas, Oregon, and Washington suggest that the desilication of clays can give rise to bauxite. [M.A. **10-497**]

R. A. H.

SUBRAMANYAM (K. V.). *Mica in Cuddapah and Anantapur districts.* Current Sci., 1960, **29**, 55.

Mica pegmatites in schistose rocks of Dharwar age are reported.

A. P. S.

KABESH (M. L.). *Mica deposits of northern Sudan.* Republic of the Sudan, Geol. Surv. Dept., 1960, Bull. **7**, 55 pp., 7 figs., 11 pls.

Mica is at present mined only in the Rubatab area on the west bank of the Nile, where pegmatites occur in Precambrian meta-sediments. The pegmatites also contain microcline, quartz, black tourmaline, spessartine garnet, beryl, and apatite. Analysis of the Rubatab muscovite gave SiO_2 45.1, TiO_2 0.4, Al_2O_3 35.1, Fe_2O_3 2.3, MgO 1.4, Na_2O 1.0, K_2O 9.8, H_2O 4.6, [=99.7]. Advice is given on the preparation of mica for sale, and details are given of the geology of the surrounding area, which includes tourmaline-bearing mica schists and quartz veins containing kyanite crystals.

R. A. H.

HOADLEY (J. W.). *Mica deposits of Canada.* Geol. Survey Canada, 1960, Econ. Geol. ser., no. 19, 141 pp.

This is a comprehensive account of mica and vermiculite deposits of Canada with particular emphasis on their geology but including much technical information in condensed form and an extensive bibliography. The report includes chapters on the following topics: physical features, properties, grading, and classification of commercial sheet mica; atomic structure of the mica-group minerals; geology of mica deposits; geology of vermiculite deposits; occurrences of mica in Canada; occurrence and production of sheet mica and vermiculite in countries other than Canada; status of the Canadian mica industry; and processes and production of ground mica.

R. J. T.

BAIRD (D. M.). *Development of gypsum deposits in southern Newfoundland.* Trans. Canad. Inst. Mining & Metall., 1959, **62**, 259-266, 5 figs.

A summary description of gypsum deposits in the Bay St. George district, southwestern coast of Newfoundland, is given. They are of high quality (90% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), and large tonnages (in excess of 200 million tons) are readily mineable. Both alabaster and a selenitic variety of gypsum are present. The evaporite horizon to which the gypsum deposits belong has a maximum thickness of 1000 feet; it occurs at the base of the Codroy Group of the Carboniferous. In the Bay St. George district the Carboniferous strata unconformably overlie Precambrian anorthosites and granite gneisses. The high-quality gypsum deposits belong to the upper half of the evaporite horizon. Anhydrite, calcite, and minor halite are mixed with the gypsum in the lower half. Evidence is brought to show that the gypsum replaced anhydrite, hydration probably being related to percolating groundwaters. $\beta\text{-CaSO}_4$ is reported to occur in a mass of gypsum-limestone.

G. P.

SUND (J. OLAF). *Origin of the New Brunswick gypsum deposits.* Trans. Canad. Inst. Mining & Metall., 1959, **62**, 395-400, 10 figs., 1 table.

The New Brunswick gypsum and anhydrite deposits

along to the Windsor group of Upper Mississippian age. They were formed by surface hydration of underlying anhydrite beds; the sub-hydrate [bassanite?], hydrate, and di-hydrate [gypsum?], which may be intermediate products in this hydration, have been observed. The Plaster Rock deposit in northern New Brunswick was precipitated from sea-water directly as gypsum.

G. P.

MUNHAM (K. C.). *Epigenetic mineralisation in Yorkshire*. Proc. Yorkshire Geol. Soc., 1959, **32**, 1-30.

A review of the occurrences of lead-zinc-copper-fluorine-barium deposits of NW Yorkshire, with a discussion of hypotheses of origin. Addition of juvenile waters to actively circulating groundwaters is the preferred hypothesis.

R. StJ. L.

CHOFIELD (M.). *Notes on strontium*. Mining Mag., 1960, **103**, 147-149.

A brief historical review of the discovery and uses of strontianite and celestine.

R. A. H.

MARRIS (J. F.). *Progress in the mineral survey of parts of Njombe and Mbeya districts*. Rec. Geol. Survey Tanganyika, 1959, **7**, 43-48.

Rare small flakes of metatorbernite occur in Buanji mines near Kimani. Some further data are given on the radioactive phosphorite at Chamoto [M.A. **14-295**]. Kaolin, with few unaltered minerals remaining, has formed as a weathering product on a large scale at Matamba. Native sulphur replaces pyrite in the gozzan of quartz-pyrite veins near Bulongwa.

D. McK.

AOA (E.). *Minor constituents and trace elements in Negev phosphate rocks*. Nature, 1958, **181**, 1676.

Averages of spectrographic and chemical analyses are reported for 17 constituents of phosphorites from Negev, Israel. Fe, Cl, Si, organic matter, Mg, Al, SO_4 , and Ti occur in amounts ranging from 1.5-0.05%. Traces occur of Cr 300, V 300, S 140, U 100, As 30, Ni 30, Cu 5, Pb 5, Mn 5 p.p.m. There is a direct relation between PO_4 and U content.

D. H. Y.

BAAR (A.). *Über die fazielle Entwicklung der Kalilagerstätte des Stassfurtflözes*. Neues Jahrb. Geol. Paläont., Abhandl., 1960, **111**, 111-135, 1 map, 11 figs.

Chemical variation of the Stassfurt horizon as seen at the Bismarckshall potash mine, south of the Harz, is represented graphically for nine profiles ranging from 350 to 650 metres in length. For one profile the mineralogical variation involving halite, sylvite, anhydrite, kieserite, polyhalite, and polyhalite is shown graphically. The genetic explanation of the chemical and mineralogical

relations is discussed with special reference to primary and secondary facies differentiation, thermometamorphism, carnallitization of 'Hartsalz', transformation by descending solutions, stable and metastable equilibrium of solutions. The author concludes that some transformations took place rather rapidly without establishment of equilibrium.

A. P.

WETHERBEE (Mrs. JULIAN). *Grand Saline salt mine*. Rocks and Minerals, 1956, **31**, 281-282 & 294.

The salt mine at Grand Saline, Texas, is described and a brief history of it given.

R. S. M.

SIEGFRIED (M.). *Primary borates in playa deposits: minerals of high hydration*. Econ. Geol., 1959, **54**, 495-501.

The four principal borate series contain inyoite ($2\text{CaO} \cdot 3\text{B}_2\text{O}_3 \cdot 13\text{H}_2\text{O}$), ulexite ($\text{Na}_2\text{O} \cdot 2\text{CaO} \cdot 5\text{B}_2\text{O}_3 \cdot 16\text{H}_2\text{O}$), borax ($\text{Na}_2\text{O} \cdot 2\text{B}_2\text{O}_3 \cdot 10\text{H}_2\text{O}$), and indurite ($2\text{MgO} \cdot 3\text{B}_2\text{O}_3 \cdot 15\text{H}_2\text{O}$); all are high hydrates of their respective series and occur as primary minerals in playa deposits. The less hydrous minerals of the four series do not occur as primary minerals. Increase in temperature decreases the hydration of the $\text{Na}_2\text{B}_4\text{O}_7\text{-H}_2\text{O}$ system from borax ($10\text{H}_2\text{O}$) through tinalconite ($5\text{H}_2\text{O}$), kernite ($4\text{H}_2\text{O}$), to metakernite ($2\text{H}_2\text{O}$). Ca, Mg, and Ca-Na hydrous borate systems apparently behave similarly. Borate minerals of higher density and lower hydration are formed from the primary borates by changes in temperature and pressure accompanying deformation and burial.

J. T. W.

MUELLER (G.). *The theory of formation of north Chilean nitrate deposits through 'capillary concentration'*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **1**, 76-86, 3 figs.

The mean abundance of nitrate throughout the north Chilean desert does not exceed that found in other arid regions. The unique secondary concentration in Chile is due to the unusual climatological asymmetry of the basins and to the 'capillary concentration' of NaNO_3 .

R. A. H.

FINGER (G. C.), RISSER (H. E.), & BRADBURY (J. C.). *Illinois fluorspar*. Circ. Illinois State Geol. Survey, 1960, **296**, 36 pp., 6 figs., 1 pl., 4 tables.

The fluorspar occurs as vein and bedded deposits. The economic uses are given.

W. A. W.

[CHENTSOV (I. G.)] Ченцов (И. Г.). Селен в отложениях палеогена Средней Азии [*Selenium in Palaeogene deposits of Central Asia*]. Труды института геологии рудных месторождений, петрографии, минералогии и геохимии [Trans. Inst. Geol. of Ore-deposits, Petr., Min., & Geochem.], 1959, **28**, 83-89, 8 figs.

The content of selenium in certain bituminous limestones in Fergana reaches 0.01% ; in their insoluble residues it rises to 0.05%. The selenium is found mainly in the finely dispersed bituminous material and sulphides in the limestones. Ferroselite from these limestones is described, and X-ray study of the mineral gives a 4.791, b 5.715, c 3.575 Å. Clausthalite, native selenium, chalcocite, and cobaltomenite are also described.

S. I. T.

CHOWDHURY (A. N.) & ROY (R. K. DUTTA). *Occurrence of selenium in sulphides in India*. Sci. & Culture, 1959, **25**, 67.

Selenium has been estimated iodometrically in some Indian sulphides.

A. P. S.

SCHNELLMANN (G. A.). *Formation of sulfur by reduction of anhydrite at Ras Gamsa, Egypt*. Econ. Geol., 1959, **54**, 889-894, 1 fig.

Native sulphur, in places contaminated by hydrocarbons, occurs in anhydrite and dolomite with interbedded marls of Miocene age. Sulphur is present as—(1) a fine dissemination in anhydrite, (2) a coarser crystalline deposit in the spaces among rosettes of crystalline aragonite, (3) coarse crystalline sulphur lining walls of fissures and cavities in dolomite. Sulphur-bearing horizons occur beneath marl. The sulphur originated from the reduction of calcium sulphates at moderate temperatures by an inorganic process involving an unidentified catalyst.

W. E. H.

LEE (C. O.), BARTLETT (Z. W.), & FEIERABEND (R. H.). *The Grand Isle mine*. Mining Eng., A.I.M.E., 1960, **12**, 578-590.

This large sulfur deposit, 7 miles off the Louisiana coast, was discovered in 1949 by an oil company. The sulfur-bearing limestone cap of the salt dome ranges in depth from 1800 ft to 2500 ft below sea level, and in sulfur content per drill hole from 15% to 30%. One exploratory well cut 75 ft of low-grade sulfur-bearing rock at 7495 ft below sea level. The ore is in a blue-gray to black, moderately hard, fine-grained, fractured limestone re-cemented by white, secondary calcite and sulfur. The sulfur occurs in crystalline masses, in vugs, and as disseminations; it is discoloured by traces of oil. The limestone also contains lenses of marl and shale and minute amounts of gypsum. Anhydrite underlies the sulfur horizon; below the anhydrite rock salt occurs to an unknown depth.

R. G. W.

SUZUKI (JUN), ISHIKAWA (TOSHIO), ÔMACHI (HOKUICHIRO), & SUZUKI (YOSHIO). *On the sulphur deposits of the Akan sulphur mine, Hokkaido, Japan*. Journ. Fac. Sci. Hokkaido Univ., 1957, ser. iv, **9**, 501-518, 9 figs., 2 pls.

The main ore deposit of the Akan sulphur mine is in the central explosion crater of Nakamachineshira of the volcano Meakan, eastern Hokkaido. It consists of (1) the lower banded ore with 25-30% S, (2) the bluish green high grade ore with 50-60% S, (3) the upper banded ore, and (4) sublimated ore forming the uppermost part of the deposit. The episodes by which such a layered deposit of sulphur mixed with other volcanic products is formed are described. Correlation of the distribution of sulphur deposits in Japan with zones of volcanic activity leads to the conclusion that such deposits are found in the regions of most calcic magma.

A. P.

ARMON (W. J.) & REES (O. W.). *Chemical evaluation of Illinois oil shales*. Circ. Illinois State Geol. Survey, 1960, **307**, 22 pp., 3 figs., 11 tables.

Four Illinois black shales and one limestone were selected for detailed study. Assay yield ranges from 7.3 to 13.3 gallons of oil per ton of shale. The specific gravity of the crude oil ranged from 0.922 to 0.952. Nitrogen measured from 1.61 to 2.02%; sulfur was high, ranging from 0.82 to 2.42%. Viscosity values are lower than those for shale oil from Colorado. The Illinois oil shales yield an average of 660 cubic feet of gas per ton of shale which has a heating value of 775 B.t.u. per cubic foot. The gas consists chiefly of hydrogen (34.9%), methane (23.4), CO₂ (13.670), and the remainder is N₂, CO, and hydrocarbons.

W. A. Wh.

HARPUM (J. R.). *Soapstones in Tanganyika*. Rec. Geol. Survey Tanganyika, 1959, **7**, 87-92.

The thirty-seven occurrences of talc-rich rocks in Tanganyika include talc-magnesite-chlorite, talc-tremolite, talc-anthophyllite, talc-chlorite, talc, and talc-quartz assemblages.

D. McK.

Uranium, beryllium, &c.

PAGE (L. R.). *The source of uranium in ore deposits*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **15**, 149-164.

Critical evaluation of the evidence suggests that few uranium deposits can be attributed to the leaching of normal detrital or igneous rocks, but that many are the result of redistribution of uranium from ore deposits, or concentrations previously formed from hypogene solutions. These hypogene solutions start escaping from magmas long before the formation of granite and continue until the end of fractional crystallization. Surface waters are effective only in leaching and redistributing the hypogene uranium in certain types of deposits, e.g. those of the Colorado Plateau.

R. A. H.

WRIGHT (H. D.), SMITH (C. M.), & HUTTA (J. J.). *Role of trace amounts of uranium in some base metal sulfides from vein deposits*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 16, 248-260.

The amount and distribution of uranium has been studied for 270 samples of pyrite, blende, and galena associated with uraninite in vein deposits of western U.S.A. The amounts varied from 1 to 5700 p.p.m. U, but homogeneously distributed uranium is limited to samples with less than 80 p.p.m. U, and it is suggested that the homogeneously distributed uranium entered the minerals by adsorption during crystallization, rather than by incorporation in the structure.

R. A. H.

NEUERBURG (G. J.) & GRANGER (H. C.). *A geochemical test of diabase as an ore source for the uranium deposits of the Dripping Spring district, Arizona*. Neues Jahrb. Min., Abhandl., 1960, 94, 759-797, 16 figs.

Uranium deposits in a potassic siltstone of the Precambrian Apache series were probably derived from associated diabase intrusives. Differentiation of the diabase gave rise to syenite, aplite, and deuteric veinlets. 27 chemical analyses are given of the diabase and related rocks, together with 5 semiquantitative spectrographic analyses of siltstone and hornfels. The distribution of U and Cu among the differentiates is consistent with removal of most of the magmatic U and little of the magmatic Cu from the intrusives. The inferred amount of U in the drained rest fluids is greatly in excess of the most optimistic estimates of ore reserves.

R. A. H.

UYTENBOGAARDT (W.). *Uranium mineralization in the Västervik area*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 15, 114-122, 3 figs.

Uranium and thorium minerals occur in quartzite and in associated gneisses and pegmatites near Västervik, on the east coast of southern Sweden. Concentrations of thucholite with traces of uraninite occur along bedding planes, faults, and fractures in non-granitized parts of the quartzite; uranium mineralization is associated with magnetite ore in granite gneisses and granitized quartzite; and davidite, thorogummite, and rutile are found in pegmatites and aplites.

R. A. H.

STRUNZ (H.) & SEELIGER (E.). *Erzpetrographie der primären Uranmineralien von Wölsendorf: Erste Feststellung von Coffinit auf einer Uranlagerstätte Mitteleuropas*. Neues Jahrb. Min., Abhandl., 1960, 94, 681-719, 43 figs.

Uraninite, pitchblende, coffinite, and 6 unidentified uranium minerals are reported from the primary uranium ores of Wölsendorf, Bavaria. Uraninite I, of high thermal

provenance, forms the well-crystallized cores of pitchblende nodules and is sometimes partially replaced by SiO_2 ; uraninite II, younger and of low thermal provenance, forms small idiomorphic crystals in fluorite. Pitchblende I, in concentric nodules with radial shrinkage fractures, alternates with carbonates, SiO_2 , or Fe_2O_3 ; pitchblende II is softer and has a lower reflecting power than normal pitchblende. Oriented intergrowths of UO_2 and pyrite and pseudomorphs of UO_2 after calcite are recorded.

R. A. H.

REIN (G.). *Ein Pechblendevorkommen bei Menzenschwand im Südschwarzwald*. Neues Jahrb. Min., Abhandl., 1960, 94, 720-732, 5 figs.

An occurrence of gel-like pitchblende and 'uranocher' (a general name for 'earth-like' alteration products of gel-like pitchblende) is described from the Rabenfelsen, near Menzenschwand, in the southern Black Forest. The uranium ore occurs in fine fissures in the outermost part of the aureole around the 'Bärhaldegranit', the latter possibly having supplied the uranium. The ore was formed at a late stage and at low temperatures.

R. A. H.

CEVALES (G.). *Erzmikroskopische Untersuchung von zehn Uranvorkommen des italienischen Perms der West- und Ostalpen*. Neues Jahrb. Min., Abhandl., 1960, 94, 733-758, 13 pls.

A microscopic investigation of the ores and their intergrowths in 10 uranium deposits in Permian sediments of the Italian Alps is reported. Reducing conditions were responsible for the precipitation of pitchblende in the arkoses. In the eastern Alps the pitchblende is partly unaltered but in the western Alps metamorphic mobilization of the uranium has occurred.

R. A. H.

WHITTLE (A. W. G.). *Contact mineralisation phenomena at the Mary Kathleen uranium deposit*. Neues Jahrb. Min., Abhandl., 1960, 94, 798-830, 4 figs., 4 pls.

The ore of the Mary Kathleen deposit [M.A. 13-247], near Mt. Isa, northwestern Queensland, consists of fine-grained uraninite disseminated through orthite-apatite enriched rock in a garnetiferous skarn. The skarn and ore formation resulted from accessions of late magmatic emanations of a differentiated granodioritic intrusive emplaced in calcareous-magnesian metasediments. The minerals formed were mainly silicates such as garnet, feldspar, orthite, prehnite, stillwellite [M.M. 31-455; M.A. 13-7], and scapolite; in the extensive skarns thus produced, uraninite and the metallic sulphides pyrrhotine, pyrite, marcasite, and chalcopyrite were deposited.

R. A. H.

ROBERTS (W. M. B.). *Mineralogy and genesis of White's orebody, Rum Jungle uranium field, Australia*. Neues Jahrb. Min., Abhandl., 1960, **94**, 868-889, 5 pls.

The pitchblende at White's mine, Rum Jungle, 40 miles SSE of Darwin, is associated principally with Cu, Co, and Pb sulphides, which are contained in a Lower Proterozoic graphitic quartz-sericite schist. Sulphide textures and the presence of tourmaline in the quartz-rich gangue suggest a hydrothermal origin for the mineralization, which may be related to the adjacent Rum Jungle granite [M.A. 12-110, 111] R. A. H.

BEAVAN (A. P.). *The Labrador uranium area*. Proc. Geol. Assoc. Canada, 1958, **10**, 137-145.

At least seventy-five occurrences of abnormal radioactivity have been discovered in an area of about 3,000 square miles, underlain by Precambrian rocks, in eastern Labrador. Mineralization consists chiefly of pitchblende in fractures and shear zones in volcanic rocks, sedimentary rocks, and fault zones. Radioactivity in granitic rocks is caused by allanite or euxenite, uraninite, and a mineral of the pyrochlore-microlite series. The lead isotope age for the mineralization is 600 ± 30 m.y. The area exhibits lithological, structural, and mineralogical similarities with Great Bear Lake and Beaverlodge uranium camps.

W. E. H.

KOSTUIK (J.) & DE BASTIANI (M. J.). *Denison mine operations at Elliot Lake*. Mining Eng., A.I.M.E., 1960, **12**, 1250-1256.

The Denison ore body, located north of Lake Huron, is one of a number of uraniferous ore bodies in pyritized conglomerate of Huronian age. The ore zones contain about 6% sulfides, including pyrite, pyrrhotine, chalcopyrite, and the uranium minerals brannerite and uraninite, with an unidentified mineral (probably thucholite). R. G. W.

MALAN (R. C.) & RANSPOT (H. W.). *Geology of the uranium deposits in the Cochetopa mining district, Saguache and Gunnison Counties, Colorado*. Econ. Geol., 1959, **54**, 1-19, 3 figs.

Significant uranium deposits occur in the Cochetopa mining district. Faults and shears traversing Precambrian, Mesozoic, and Tertiary rocks controlled the movements of uranium-bearing hypogene solutions. Uranium minerals are localized in the silicified and brecciated Mesozoic and Tertiary sediments; the most common is pitchblende, associated with abundant clay and minor amounts of marcasite. Secondary autunite and uranophane occur in the brecciated and silicified mudstones of the Brushy Basin shale member of the Morrison formation. A minor amount

of an unidentified orange-yellow uranium mineral is found in pegmatite intruding schist. Uranopilite, zippeite, and johannite form encrustations on mineralized schist shortly after exposure to the atmosphere. Spectrochemical data indicating distribution of elements in wall rocks adjacent to and distant from ore and in ore itself are presented and provide the basis for concluding that silicification, by hydrothermal solutions which preceded the ore, formed the appropriate environment for later deposition of primary uranium minerals. G. S. C.

MACKEVETT (E. M., Jr.). *Geology and ore deposits of the Kern River uranium area, California*. Bull. U.S. Geol. Survey, 1960, **1087-F**, 169-222.

Small epithermal deposits of uranium are distributed along fractures in granodiorite (90 m.y. by Pb- α age determination). The principal ore mineral is autunite (meta-autunite I); less common are sooty pitchblende, carnotite, and metazeunerite. Ilsemanite and jordisite, fluorite, montmorillonite, gypsum, and limonite accompany the pitchblende. The area also contains small deposits of gold, in lodes and in placers, and of wolfram. K. S.

WEIR (G. W.) & PUFFETT (W. P.). *Similarities of uranium-vanadium and copper deposits in the Lisbon Valley area, Utah-Colorado, U.S.A.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **15**, 133-148, 7 figs.

The geological similarities of these deposits suggest that they all have a common origin. The U-V deposits are in Permian, Triassic, and Jurassic sedimentary rocks, and the Cu deposits occur chiefly in Cretaceous sandstones. The Cu ores are considered to have been deposited from low-temperature hypogene solutions moving along faults during the Tertiary period: U-V ores were probably deposited from similar solutions moving laterally through favourable beds. R. A. H.

[CHENTSOV (I. G.)] Ченцов (И. Г.). Вопросы минералогии и геохимии некоторых осадочных урановых рудопоявлений [Problems of mineralogy and geochemistry of certain sedimentary uranium ore occurrences]. Труды института геологии рудных месторождений, петрографии, минералогии и геохимии [Trans. Inst. Geol. of Ore-deposits, Petr., Min., & Geochem.], 1959, **28**, 43-82, 48 figs.

This is a detailed study of uranium-vanadium enriched bituminous material as it occurs in bituminous limestones of Mesozoic-Kainozoic age. First the primary concentration of U, V, Mo, Ni, Co, and other metals in the asphalts and other bitumens found in limestones is studied; a special study of the distribution of organic matter in various textural types of limestones is made. The concentration of

these metals during the diagenetic and subsequent stages is traced to various agencies such as the migration of petroleum, gas, and oil-water. A record of 69 minerals found in these deposits provides material for a geochemical paragenetic table-diagram for a double triangular diagram $\text{CaO}-\text{UO}_3-\text{V}_2\text{O}_5-n\text{H}_2\text{O}-\text{SiO}_2$ which helps to explain the various orders of deposition of various uranium and vanadium minerals. The localization of uranium-vanadium deposits is also traced to lithological and tectonic factors.

S. I. T.

[GINZBURG (A. I.), ZHURAVLEVA (L. N.), IVANOV (I. B.), & SHCHERBINA (V. V.)] Гинзбург (А. И.), Журавлева (Л. Н.), Иванов (И. Б.) и Щербина (В. В.). Геология месторождений редких элементов [*The geology of deposits of rare elements*]. No. 3. Редкоземельные элементы и их месторождения [*The rare-earth elements and their deposits*]. Гос. Науч.-Техн. Изд. [State Sci.-Tech. Publ.], 1959, 125 pp., 9 figs. Price 5r.95k.

This is a very useful collection of data relating to the rare-earth elements—their distribution, occurrence, minerals, rocks, geochemistry. The chapters are: I. IVANOV. Fundamental data relating to the rare-earth elements (pp. 4–12); II. ZHURAVLEVA. The use of the rare-earth elements in industry (pp. 12–22); III. ZHURAVLEVA. Production and utilization of the rare-earth elements (pp. 22–28); IV. IVANOV. The distribution of the rare-earth elements (pp. 28–30); V. IVANOV. Minerals of the rare-earth elements (pp. 30–44); VI. SHCHERBINA. Geochemical principles of the separation of the rare-earth elements (pp. 44–59); VII. GINZBURG & ZHURAVLEVA. Genetic types of the deposits of the rare-earth elements (pp. 59–104); GINZBURG. Conclusions (pp. 104–109); CHERNYSHEVA (L. V.). Bibliography (pp. 110–125).

S. I. T.

[NIKITIN (V. D.), SADOVSKIĖ (YU. A.), & FILIPPOV (V. A.)] НИКИТИН (В. Д.), Садовский (Ю. А.) и Филиппов (В. А.). Природа ниобо-танталовой минерализации в редкометаллических пегматитах [*The nature of the niobo-tantalum mineralization in the rare-metals pegmatites*]. Зап. Лен. Горн. Инст. [Mem. Leningrad Mining Inst.], 1959, **35**(2), 3–28, 16 figs.

Certain pegmatite veins from Kazakhstan are described. It is suggested that pegmatite veins were formed in tectonically mobile zones under the influence of several tectonic phases. It is also suggested that the formation of columbite-tantalite in these pegmatites occurred in solid pegmatite under the influence of mineralizing post-magmatic solutions.

S. I. T.

GREENWOOD (ROBERT). *Availability of cesium for ion rockets*. Mining Eng., A.I.M.E., 1960, **12**, 482–483.

Most of the caesium in igneous rocks is in the micas and potash feldspars of granites and, especially, granitic pegmatites, rising markedly in the micas of the late hydrothermal replacement stage in complex pegmatites. When caesium is present in larger concentrations than can be taken up in potassium minerals, it forms the mineral pollucite. On the igneous rocks weathering, caesium ultimately is incorporated as an interlayer ion in the clay minerals of marine sediments, which typically contain 5 to 7 p.p.m. of Cs_2O . Pollucite closely resembles quartz in appearance and properties; more pollucite might be discovered if the micas of complex pegmatites were examined for caesium. A leaner reserve of caesium may lie in lepidolite and beryl; these minerals should be checked spectrographically or by flame photometer for abnormal caesium content.

R. G. W.

PETERSON (RICHARD G.), HAMILTON (JOHN C.), & MYERS (ALFRED T.). *An occurrence of rhenium associated with uraninite in Coconino County, Arizona*. Econ. Geol., 1959, **54**, 254–267.

Twenty-nine samples of sedimentary rocks of Triassic age from the Sun Valley uranium mine in northern Arizona were analyzed spectrographically; eleven were found to contain 0.005 to 0.1% of rhenium. The rhenium is associated with uranium and molybdenum (and probably with lead and zinc); it is probably in the form of the water soluble oxide (Re_2O_7) or perhenic acid (HReO_4). This rare element may have been contained originally in the mineral jordisite, as suggested by the association of the rhenium oxide with the water-soluble ilsemanite. The Sun Valley mine is the only uranium deposit on the Colorado Plateau known to contain any rhenium.

W. E. H.

STAGER (H. K.). *A new beryllium deposit at the Mount Wheeler mine, White Pine County, Nevada*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B70–71.

The principal beryllium minerals are phenakite and bertrandite. They are intimately associated with scheelite, fluorite, pyrite, sericite, manganian chalybite, and locally with small amounts of galena and blende.

K. S.

HAWLEY (C. C.), SHARP (W. N.), & GRIFFITHS (W. R.). *Pre-mineralization faulting in the Lake George area, Park County, Colorado*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B71–73, 1 fig.

The beryllium deposits are small replacement veins and pipes localized by fractures and rock contacts.

K. S.

SHARP (W. N.) & HAWLEY (C. C.). *Bertrandite-bearing greisen, a new beryllium ore, in the Lake George district, Colorado*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B73–74.

The bertrandite-bearing greisen is a local variant of normal greisen in the district, and locally is abundant enough to form an ore. The bertrandite forms pale flesh-coloured aggregates and grains evenly distributed through the rock.

K. S.

MULLIGAN (ROBERT). *Beryllium occurrences in Canada (preliminary account)*. Geol. Survey Canada, 1960, Paper 60-21, 40 pp.

Short descriptive accounts are given of more than fifty localities in Canada where beryllium minerals have been found. Brief notes are also included on world production, uses and technology, mineralogy, sight recognition of minerals, tests for beryllium, mineral associations, types of deposits and geological setting. References are given to previously published information on Canadian beryllium occurrences.

R. J. T.

ROSE (E. R.). *Rare earths of the Grenville sub-province, Ontario and Quebec*. Geol. Survey Canada, 1960, Paper 59-10, 41 pp.

Several hundred occurrences of minerals containing rare-earths in the Grenville region of Ontario and Quebec are listed alphabetically by townships, and some of the deposits visited are described. Types of occurrences include: as accessory minerals in granitic, alkalic, and gabbroic rocks; in pegmatites; as accessory minerals in metamorphic rocks; as introduced minerals in vein and replacement deposits; and in sedimentary deposits. Most occurrences are in granitic pegmatite dykes. None of the deposits contains sufficient amounts of rare earths to permit mining under present economic conditions except possibly as by-products. The uranium deposits of the Blind River and Bancroft areas of Ontario and the niobium deposits of the Oka and Lake Nipissing areas of Quebec and Ontario are the most promising sources.

R. J. T.

Metallic ore minerals and deposits

LIEBENBERG (W. R.). *On the origin of uranium, gold and osmiridium in the conglomerates of the Witwatersrand goldfields*. Neues Jahrb. Min., Abhandl., 1960, **94**, 831-867, 8 pls.

Uraninite and iridosmine are shown to belong to the heavy detrital suite of minerals in the Witwatersrand conglomerates. The particles of gold exhibit a 'pseudo-hydrothermal' shape claimed to be due to metamorphism. A sympathetic relationship between the amounts of Au, U, and Os in the conglomerates shows that the gold, uraninite, and iridosmine are consanguineous and since the two latter minerals are alluvial it is claimed that the gold also is alluvial. Other theories are examined but are

considered to be inadequate to controvert the placer theory. [M.A. **12**-278, **13**-340, 633, **14**-345, 395, 400]

R. A. H.

ISHIBASHI (M.). *Au-Ag-tellurides from the Daté mine, Hokkaido, Japan*. Mem. Fac. Eng., Hokkaido Univ., 1960, **11**, 73-84, 3 figs.

Microscopic study, mainly by means of etch test, of polished specimens of gold-bearing quartzose ores from the Daté mine, Hokkaido, showed the presence of krennerite, hessite, and petzite as Au-Ag-telluride minerals. The parageneses of these ores and of related massive sulphide ores of 'black ore' type of this mine, and similar deposits of Japan are discussed. It is made clear that the combination of Au, Bi, and Te varies according to differences of geological environment. Under volcanic hydrothermal conditions Au and Te combination is common, while under plutonic hydrothermal conditions Te combines with Bi rather than Au. It is interesting that the mineralization under metamorphic conditions is similar to the volcanic. [*Black ore deposits (=Kuroko deposits) are massive hydrothermal replacement ore deposits, consisting mainly of mixed ores of blende, galena, chalcopyrite, pyrite, and baryte, and are found only in the green tuff region of the Tertiary in Japan.]

M. S. J.

JASKOLSKI (S.) & MOCHNACKA (K.). *Złoże cyny w Gierczynie w górach Izerskich na Dolnym Śląsku i próba wyjaśnienia jego genezy* [Tin deposit at Gierczyn in Iser Mountains, Lower Silesia, and its possible genesis]. Arch. Min., [Warsaw], 1959, **22**, 17-77, 9 figs., 8 pls., 2 tables, [English summary].

Cassiterite in close association with pyrrhotine, chalcopyrite, blende, galena, arsenopyrite, and some accessories is described from the ore deposit of Gierczyn in western Sudeten. The ore bodies occur as small concordant lenses in mica-schists which were strongly folded during Caledonian orogenesis. The mineralization is regarded as caused by hydrothermal emanations from late Variscan granitic intrusions which outcrop about 10 km further south.

W. S.

KAZMITCHEFF (A.). *Observations sur la pegmatite de Tshonka (Nord-Lugulu, Kivu)*. Ann. (Bull.) Soc. géol. Belgique, 1959-1960, **83**, 227-243, 8 figs.

This pegmatite occurs as replacement veins and pockets in a dike of fine-grained, granitoid rock, which is mineralized with cassiterite and columbo-tantalite. Some detailed sections obtained at the working quarry are described.

J. M.

DENNIS (JOHN G.). *Note on some cassiterite-bearing pegmatites near Brandberg, South West Africa*. Econ. Geol., 1959, **54**, 1115-1121, 4 figs.

Cassiterite-bearing pegmatites occur in Precambrian (lower Damara) schists. Most of the pegmatites are in steeply dipping fractures parallel to layering in two small granite bodies. Near the parent granite cassiterite, commonly accompanied by tourmaline, occurs preferentially at apophyses of the pegmatite dikes, small satellite lenses, and similar structures. Farther from the parent granite cassiterite occurs in central quartz zones and cross-cutting quartz stringers within pegmatites, and also in quartz lenses directly associated with mineralized pegmatites. In many places, the pegmatites grade into quartz veins away from the granite.

G. S. C.

ЧУРИКОВ (V. S.) [Чуриков (B. C.)]. Некоторые особенности химического состава вольфрамитов [*Certain features of the chemical composition of wolframites*]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-dep., Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, 235-250, 1 fig.

Wolframites from the North Kounrad deposits in central Kazakhstan were the objects of this study. Samples of wolframite crystals were systematically collected from different parts of veins and a large number of chemical analyses were made. A regular change in the chemical composition and specific gravity of wolframite was observed to take place across and along the veins suggesting change concomitant with the progressive crystallization of minerals from ore solutions; the early high temperature types are the richest in iron.

S. I. T.

OURNEAY (J. A.), THURMOND (R. E.), & others. *Pima: a three-part story—geology, open pit, milling*. Mining Eng., A.I.M.E., 1958, 10, 453-462.

At this new mine, 20 miles southwest of Tucson, Arizona, the main high grade ore zone is in a hornfels of grossular, diopside, and tremolite, in dolomite and limestone. The principal ore mineral is chalcopyrite, with minor amounts of chalcocite, native copper, chrysocolla, tenorite, bornite, and cuprite. In the hanging-wall clastic and pyroclastic rocks pyrite is widely disseminated, and there are zones of low-grade chalcopyrite mineralization; the rhyolites and andesites present are not mineralized. In the footwall and host rocks the bulk of the quartz monzonite-porphyry present is slightly mineralized by pyrite and chalcopyrite.

R. G. W.

WAYNE (WILLIAM H.) & TRASK (FRANK). *Geology of El Salvador*. Mining Eng., A.I.M.E., 1960, 12, 344-348.

This large, new mine in northern Chile is a major porphyry copper deposit. The most important primary ore mineral is chalcopyrite; bornite is commonly observed but sparsely distributed; molybdenite as fine disseminations and veinlets is an important accessory mineral; pyrite is widely but unevenly distributed in fine seams, veinlets, and dis-

seminations; and enargite and famatinite are rare. The ratio of iron to copper appears abnormally low in comparison with other porphyry copper deposits. Primary alteration of original mafic minerals to biotite is widespread. Anhydrite occurs in a deep central zone associated locally with molybdenite and bornite. Tourmaline is present in assemblages of normal hydrothermal alteration minerals. In the zone of secondary enrichment, chalcocite predominates, but small amounts of covellite and minor relics of chalcopyrite and bornite are observed. Locally, minor amounts of cuprite and native copper are found in veinlets near the bottom of the enrichment zone. Most of the ore reserves are in the form of chalcocite. Powdery maroon limonite after chalcocite is present in the extensive leached capping.

R. G. W.

TAKEUCHI (TSUNEHICO) & NAMBU (MATSUO). *Cubanite from No. 2 Shinyama copper deposit of Kamaishi mine, Iwate Prefecture*. (*Studies on the cubanite-bearing ores in Japan*: V.). Journ. Japanese Assoc. Min., Petr., & Econ. Geol., 1958, 42, 101-104, 1 fig., 2 tables, (in Japanese; English summary).

Cubanite occurs in the contact-metasomatic No. 2 Shinyama copper deposit in Kamaishi mine, Japan. The lump cubanite occurs in most cases in paragenesis with pyrrhotine, chalcopyrite, and pentlandite, but rarely with pyrite, blende, and valleriite. It often occurs as an intimate intergrowth with chalcopyrite, pentlandite, pyrrhotine, and blende due to the unmixing of solid solution between them. Chemical analysis [analyst not mentioned] of the mineral including small quantity of pentlandite, blende and quartz shows: Cu 23.30, Fe 41.23, S 34.81, Ni 0.11, Zn 0.03, SiO₂ 0.51, =99.99. Chemical analysis of cubanite from Omine mine, also given, shows: Cu 23.91, Fe 40.95, S 35.06, Ni 0.06, Zn tr., SiO₂ 0.16, =100.14. X-ray powder data are given.

I. S.

MONSEUR (G.). *Observations sur des gisements métallifères de la région de Torrelavega (Province de Santander, Espagne)*. Ann. (Bull.) Soc. géol. Belgique, 1959-1960, 83, 209-223, 3 figs., 4 photos.

Deposits of barytes are residual; calamine-galena mineralizations are located in a zone of oxidation; zoned blende with specks of galena occurs as veins. These three mineral occurrences belong to a single type of deposit, but correspond to three different depth levels; they are referable to the very general 'Mississippi Valley' type.

J. M.

JASKÓLSKI (S.) & BANAŚ (M.). *Złożowe i mikroskopowe obserwacje jordanitu w górnośląskich złożach cynkowo-olowiowych* [Some observations on jordanite occurring in Upper-Silesian zinc-lead deposits]. Arch. Min. [Warsaw], 1959, 22, 5-13, 2 figs., 2 pls., 2 tables, (English summary).

Jordanite ($\text{Pb}_4\text{As}_2\text{S}_7$) from the zinc-lead mine at Bytom is described. Jordanite appears in paragenesis with blende, galena, and a mineral which is classed as an anomalous galena.

W. S.

ŻABIŃSKI (W.). *Charakterystyka mineralogiczna strefy utlenienia Śląsko-Krakowskich złóż kruszców cynku i ołowiu* [The mineralogy of the oxidation zone of Silesia-Cracow zinc and lead deposits]. Polska Akad. Nauk, Prace Geol., Warszawa, 1960, 1-70, 22 figs., 8 pls., 32 tables, (English and Russian summaries).

The Silesia-Cracow zinc ore deposits occur mainly among dolomitic and calcareous Triassic sediments. The ore deposits consist of zinc sulphides (blende, less frequently wurtzite, or a mixture of these polymorphs), galena, and iron sulphides (marcasite, pyrite). The sulphoarsenates jordanite [A. Sachs 1904, C. Haranczyk 1957] and gratonite [P. Ramdohr 1942] are noted as minerals of very rare occurrence. The main mass of ore minerals has a meta-colloidal character and only galena presents crystalline form. The deeper parts of the deposit are preserved as sulphides by protection from surface infiltration by a layer of clay; the upper, near surface parts have been partly or entirely oxidized.

The problem of dolomitization of Triassic sediments and origin of lead and zinc is a controversial subject. Some of the adherents of the epigenetic theory regard the Mg, Zn, and Pb compounds as derived in solution from not clearly defined magmatic centres [The hypothesis of ascension, telemagmatic deposits, F. Duvensee, 1929, F. Wernicka 1931]; others claim that Zn and Pb compounds, originally dispersed in calcareous sediments, were concentrated by circulating waters and then as a result of their reduction, the sulphide ores have been precipitated [the hypothesis of descent, R. Stuppenbeck, 1928]. The adherents of the syngenetic theory [G. Gurich 1903, K. Keil 1956, H. Gruszczyk 1956] claim that the dolomites and sulphide ores were precipitated from the waters of Triassic sea and then subsequently altered during processes of diagenesis.

W. S.

GRAFENAUER (S.). *Seltene natürliche Bleioxyde von Mežica (Mies), Jugoslavien*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1187-1190, 2 pls.

Minium, litharge, and massicot have been identified from the lead ore deposit at Mežica (Mies), Yugoslavia, by X-rays and ore microscopy.

R. A. H.

CARTER (G. S.). *Drilling and geochemical investigations at Uruwira Minerals Limited*. Rec. Geol. Survey Tanganyika, 1960, **8**, 72-78.

KING (A. J.). *Prospecting for lead in the Mpanda area*. Rec. Geol. Survey Tanganyika, 1960, **8**, 79-85.

Geochemical, magnetic, spontaneous polarization, and resistivity surveys have been used to investigate the galena-chalcopyrite mineralization in a quartz-siderite gangue associated with a shear zone in western Tanganyika.

D. McK.

FROHBERG (M. H.) & NUFFIELD (E. W.). *Über ein ungewöhnliches Vorkommen von Millerit auf Temagami Island, Temagami Distrikt, Ontario*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1183-1186.

Unusually large massive aggregates of millerite and crystal up to 4 mm in diameter are recorded from Temagami Island, 30 miles southwest of the Cobalt silver mining camp, Ontario, on the periphery of two massive chalcopyrite bodies. The millerite is associated with gersdorffite and chalcopyrite in quartz veins extending from the surrounding rhyolite into the margins of the chalcopyrite masses; it is considered to have a hydrothermal origin.

R. A. H.

FAWLEY (A. P.). *Mwanzan Hill nickel deposit, Central Province*. Rec. Geol. Survey, Tanganyika, 1959, **7**, 49-54.

Nickelian serpentine, nickelian magnetite, and garnierite occur in a serpentinite body.

D. McK.

MILLS (JOSEPH W.). *Geologic setting of the nickel occurrence on Jumbo Mountain, Washington*. Mining Eng. A.I.M.E., 1960, **12**, 272-274.

Nickel mineralization, discovered in 1956, is in shear zones following the contact between dunite dikes and folded Tertiary sediments, largely quartzites. The dunite is composed almost entirely of iron-poor olivine, or its alteration products, talc, tremolite, and serpentine, and small pyrrhotine grains. Locally schistose borders are mineralized with pyrrhotine and pentlandite, the latter in tabular, fractured crystals up to $\frac{1}{4}$ in diam. Polished sections show the presence of minor chalcopyrite.

R. G. W.

HUBAUX (A.). *Les gisements de fer titané de la région d'Egersund, Norvège*. Neues Jahrb. Min., Abhandl., 1960, **94**, 926-992, 10 figs., 4 pls.

The ilmenite lenses south of Egersund are considered to belong to a basic front created by the migmatitisation of a magmatic norite included in a big anorthositic and leucocratic noritic complex [M.A. **14**-372]. In the magmatic rocks of this region the ilmenite, magnetite, and orthopyroxene have a poecilitic texture: these grains are supposed by the author to be the product of the final stage of the contemporaneous crystallization of magnetite and ilmenite. It is concluded that the ore minerals are the last to crystallize in magmatic rocks and are the first to be expelled from

the rock when it takes part in migmatitisation or anatexis. The ilmenite grains have a strong tendency to be convex.

R. A. H.

MARKHANAVALA (M. D.), MOMIN (A. C.), & REGE (S. G.). *An X-ray study of leucoxene from Quilon, India.* Econ. Geol., 1959, **54**, 913-918.

Commercial concentrates of leucoxene from Quilon contain chiefly rutile, pseudobrookite, anatase, and small amounts of hematite.

W. E. H.

ARTER (G. S.). *The Liganga titaniferous magnetite occurrences.* Rec. Geol. Survey Tanganyika, 1960, **8**, 67-71.

Magnetite-spinel (?chromohercynite)-ilmenite-chlorite bodies have an intrusive, late-stage magmatic relationship to the Liganga gabbro-anorthosite complex of Bukoban ge. The magnetite contains {111} exsolution lamellae of hematite. Two chemical analyses of ore samples are given.

D. McK.

ANKWITZ (P.). *Zur Tektonik der Magnetitlagerstätten im Thüringer Wald.* Neues Jahrb. Min., Abhandl., 1960, **94**, 1359-1368, 1 fig., 2 pls.

Lenses of magnetite ore occur in the inner contact aureole of the upper Thüringer granite, Germany. Magnetite forms 90% of the ore minerals and usually appears in idiomorphic grains; it is accompanied by garnet, orthite, hematite and pyrite. The textures of the ores are parallel to those of the surrounding rocks: the intrusion of the granite was accompanied by rupture of the mineral grains.

R. A. H.

UNHAM (K. C.). *Syngenetic and diagenetic mineralization in Yorkshire.* Proc. Yorkshire Geol. Soc., 1960, **32**, 229-284, 4 figs.

The bedded iron ores, sulphide-bearing black shales, and evaporites of Yorkshire are described. The presence of abundant decaying vegetable or animal matter to provide the necessary low Eh, low pH, and available CO₂, is held to be fundamental to the formation of the Coal Measures claystones and the Jurassic chalybitic chamosite-oolites. Silicate, silicate+carbonate, carbonate, and sulphide facies are recognized in the Cleveland ores, and the primary chamosite oolites are regarded as having formed in the region between the carbonate and oxide zones rather than in the sulphide facies. Al and Si are necessary, in addition to Fe²⁺, for the formation of the silicate ores. Hypotheses for the transportation and precipitation of the iron, together with the role of diagenesis in this type of mineral concentration, are considered. The zonal distribution of minerals within the Permian evaporites leads

to important palaeogeographical and stratigraphical conclusions, and the effects of later changes due to migrating brines are emphasized.

B. W. E.

[SERDYUCHENKO (D. P.), GLEBOV (A. V.), KADENSKAYA (M. I.), LEONOVA (E. P.), KADENSKIĬ (A. A.), & PAVLOV (V. A.)] Сердюченко (Д. П.), Глебов (А. В.), Каденская (М. И.), Леонова (Е. П.), Каденский (А. А.) и Павлов (В. А.). Железные руды Южной Якутии, геология, минералогия, генезис и промышленное значение [*Iron ores of southern Yakutia, their geology, mineralogy, genesis, and industrial importance*]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1960, 519 pp., 175 figs. Price 33r.65k.

The newly discovered magnetite ores of the Aldan region in South Yakutia are found intercalated among the schists, tourmaline rocks, marbles, and calciphyres of upper Archaean age. Magnetite, magnetite-quartz, and magnetite-silicate ores and the less frequent martite and hematite ores are considered to be of primary sedimentary origin, highly altered by deep-seated regional metamorphism and, to a certain degree, affected by later granitic intrusions. The present volume is the report of a series of expeditions over the period 1950-1958. It contains twenty-one articles dealing with the geology, petrology, and mineralogy of the ores and the associated metamorphic rocks. Only brief mention of the subjects of these articles is possible here. Articles written by Serdyuchenko are: geological structure of the region (p. 13), apatites and apatite rocks (p. 274), sulphides of iron and minerals of copper (p. 282), spinels (p. 295), pyroxenes (p. 313), amphiboles (p. 326), magnesium-iron micas (p. 358), scapolites (p. 382), epidotes (p. 403), chlorites (p. 407), minerals of the talc group (p. 428), genesis of ores (p. 437), industrial values of the ores (p. 480). Articles written by Serdyuchenko and Glebov are—quartzites and quartzite-gneiss (p. 33), tourmalines and tourmaline rocks (p. 245), forsterite and the minerals of the humite group (p. 305); by Serdyuchenko and Kadenskaya—scapolite rocks (p. 61); by Serdyuchenko and Kadenskiĭ—cordierites (p. 401); by Serdyuchenko and Leonova—marbles and calciphyres; by Serdyuchenko and Pavlov—garnets (p. 394). Besides these a number of articles describes the geology of the iron ore occurrences in various districts of the Aldan region. The text is provided with numerous illustrations and the book contains a number of chemical analyses of rocks, minerals, and ores and other data. The bibliography (pp. 507-517) contains a number of references to works on iron ores in Sweden, U.S.A., and elsewhere.

S. I. T.

FRIEDMAN (GERALD M.). *The Samreid Lake sulphide deposit, Ontario, an example of a pyrrhotite-pyrite iron formation.* Econ. Geol., 1959, **54**, 268-284, 3 figs.

The Samreid Lake sulphide deposit lies about 30 miles NNE of Blind River, Ontario. The essential minerals are pyrrhotine and pyrite. Magnetite is abundantly intergrown with the sulphides. Minor sulphides include marcasite, chalcopyrite, and cubanite. Base metal sulphides are not present. Mineralization is confined to quartzite and to lava flows within 10 ft of quartzite. Magnetite is considered to have been precipitated in a marine environment within an area of volcanic activity in which the clastic sediments were permeated by an effusion of H_2S which converted iron oxide gels and perhaps some magnetite to pyrite. Pyrrhotine is considered to have formed at the expense of pyrite during a post-geosynclinal orogeny. Geological thermometry points to a temperature of formation of 420° to $600^\circ C$ for the deposit, reflecting post-depositional metamorphic conditions. G. S. C.

LAGANZA (R. F.). *Pyrite investigations at Nairne, South Australia*. Econ. Geol., 1959, **54**, 895-902, 4 pls., 3 tables.

The sulfide deposit, the Nairne Pyrite Formation, contains at least five varieties of FeS_2 ; three are of secondary origin. The main part of the FeS_2 is pyrite which probably owes its origin to sedimentary and subsequent metamorphic processes. Some of the FeS_2 occurs as pyrite in relatively large veins containing a suite of Ag-Sb minerals and may be of hydrothermal origin. Two varieties of secondary FeS_2 are the result of pyrrhotine alteration. One, characterized by a porous, concentric structure, consists of pyrite or marcasite, or pyrite and marcasite; it is extremely fine grained, thus presenting problems in flotation. The other, a zoned pyrite, may be either a direct replacement of the pyrrhotine or a replacement of the concentric FeS_2 . The third variety of secondary FeS_2 occurs with zeolite, chalybite, and limonite, and is definitely a product of weathering. W. E. H.

MACDONALD (R. D.). *Iron deposits of Wabush Lake, Labrador*. Mining Eng., A.I.M.E., 1960, **12**, 1098-1102.

Iron-bearing formations discovered in 1933 and systematically explored since 1949 are now under development. In the Wabush Lake area the iron formation is a more highly metamorphosed extension of the iron formation of the Labrador-Ungava trough. A gneissic rock containing black amphibole, quartz, feldspar, and pink garnet occurs in close association with some orebodies and with gabbro intrusives. The three facies of the iron formations are a carbonate member, a silicate-carbonate member, and an oxide member, the latter usually at the top. The oxide member is characterized by a lower magnetite-rich zone and an upper specularite-rich zone. Grunerite and magnetite occur together in a narrow zone below the main oxide zone. R. G. W.

ANCION (C.). *Visite au gisement de minerai de fer de Gara Djebilet (Tindouf, Sahara Occidental)*. Ann. (Bull. Soc. Géol. Belgique, 1959-1960, **82**, 267-282, 3 figs.

This deposit, composed of semi-phosphoric ore, comprises beds of oolitic mineral and lies at the base of the Emsian (Lower Devonian). It is of sedimentary origin and has an essentially chemical, authigenic character. There is no evidence of metamorphism. The ore contains a high proportion of magnetite, hematite, chalybite, goethite, and chlorite. Phosphorus is present as apatite. The most magnetic part of the deposit has an estimated 400 million tons of ore averaging 57.7 Fe. The total tonnage is of the order of several thousand million tons. Average content of non-ferrous oxides is SiO_2 4.6, CaO 1.5, Al_2O_3 4.3, $H_2O + 3P_2O_5$ is variable, diminishing with increasing Fe. J. M.

AUGUSTITHIS (S. S.). *Alterations of chromite. Ore-microscopic observations on chromite-ores from Rodiana, Greece*. Neues Jahrb. Min., Abhandl., 1960, **94**, 890-904, 7 pls.

A decolorized outer zone of some Greek chromites is due to reaction between the ore and later formed serpentine. Ilmenite, rutile, and anatase also occur, and talc and carbonates result from hydrothermal processes.

R. A. H.

SARMA (S. R.). *Chromite from Wankur*. Neues Jahrb. Min., Abhandl., 1960, **94**, 905-907, 2 figs., 1 pl.

A small lens of chromite ore occurs in hornblende schist and gneisses near Wankur, Khammam district, Andhra Pradesh, India. Quartz occurs with the chromite and some of the marginal chromite grains are shattered; it is suggested that the lens is a metamorphosed fossil place deposit. A chemical analysis of the ore is given.

R. A. H.

JENNESS (S. E.). *'Magnetic' chromite from Shoal Point, northeastern Newfoundland*. Econ. Geol., 1959, **54**, 1298-1301, 2 figs.

The magnetic properties of the occurrence are attributed to microscopic veinlets of magnetite in some chromite grains; the irregular pattern of the veinlets is indicative of fracture filling since no preference for the crystallographic directions of chromite is shown. J. T. W.

EL SHAZLY (E. M.) & SALEEB (G. S.). *Contributions to the mineralogy of Egyptian manganese deposits*. Econ. Geol., 1959, **54**, 873-888.

Manganese deposits in Egypt are found in two main areas; west central Sinai and the Eastern Desert. The manganese-iron deposits of west central Sinai occur as lenses and lenticular bands in a Carboniferous dolomite.

onestone-clay horizon; smaller deposits are found in sandstone. Scattered manganese deposits with subsidiary iron minerals occur in the Eastern Desert in faults of Late Miocene age. The ore fills fault zones and fissures or replaces favourable wall rocks (limestone and conglomerate of the Middle Miocene sedimentary series). Locally the manganese-bearing fissures cut Precambrian rocks. Pyrochroite, manganite, psilomelane, cryptomelane, ramsdellite, cerussite, and hematite have been recognized and described according to their respective X-ray powder patterns, reflectivity, microhardness, and optical properties.

W. E. H.

KAKEUCHI (TSUNEHICO), SUGAKI (ASAHIKO), SUZUKI (TERUO), & ABE (HIROSHI). *Ore deposits of the Ōhori mine, Yamagata Prefecture*. Mining Geol., Japan, 1960, **10**, 8-28, 22 figs., 7 tables, (Japanese with English summary).

Geology and ore deposits of the Ōhori mine are described in detail. There are two different types of ore deposits. The bedded type is considered to have been formed by metasomatic replacement of a calcareous bed. Minerals found in this deposit are blende, chalcopyrite, pyrite, malena, wollastonite, bustamite, garnet, diopside, rhodonite, epidote, quartz, calcite, and rhodochrosite; of these, garnet and bustamite are studied in detail. One of two chemical analyses of garnet [analyst not stated] is SiO_2 36.13, TiO_2 0.79, Al_2O_3 15.73, Fe_2O_3 7.31, FeO 0.31, MnO 4.00, MgO 0.09, CaO 33.10, $\text{H}_2\text{O}+$ 0.82, $\text{H}_2\text{O}-$ 0.48, =99.76; from X-ray powder data, a is $11.885 \pm 0.001 \text{ \AA}$. Bustamite occurs as radial aggregates of fibrous crystals, light grey to brownish grey in colour. It shows straight extinction with positive elongation, α 1.678, γ 1.685, $\gamma'-\alpha'$ 0.007. Chemical analysis [analyst not stated] gives: SiO_2 45.65, TiO_2 0.08, Al_2O_3 1.12, Fe_2O_3 1.02, FeO 1.48, MnO 27.34, MgO 2.41, CaO 18.91, $\text{H}_2\text{O}+$ 1.16, $\text{H}_2\text{O}-$ 1.07, =100.24, with chemical formula of $(\text{Ca}_{0.44}\text{Mn}_{0.50}\text{Fe}_{0.03}\text{Mg}_{0.08})_{1.05}\text{Si}_{0.98}\text{O}_{3.00}$. X-ray powder patterns are in good agreement with previous data on bustamite. The other type of deposit is of vein form.

M. S. J.

THE INSTITUTION OF MINING AND METALLURGY. *The future of non-ferrous [metalliferous] mining in Great Britain and Ireland: a symposium*. London (Inst. Mining & Metall.), 1959, xxvi+614 pp., 69 figs., 12 pls. Price £3.

The Proceedings of this symposium, arranged by the Institution of Mining and Metallurgy in collaboration with the United Kingdom Metal Mining Association and held in September, 1958, contain many papers of mineralogical interest, including:

- GRAY (ANTON). *The future of mineral exploration. The fourth Sir Julius Wernher Memorial Lecture*. Pp. xi-xxvi. [M.A. **14**-474]
- O'BRIEN (M. V.). *The future of non-ferrous mining in Ireland*. Pp. 5-26, 2 figs. [M.M. **32**-128; M.A. **14**-476]
- FOWLER (A.). *The non-ferrous minerals of Northern Ireland*. Pp. 27-34, 2 figs.
- MACKAY (R. A.). *The Leadhills Wanlockhead mining district*. Pp. 49-64, 1 pl. [M.A. **14**-395]
- BARNETT (G. W. T.). *Lead in Islay*. Pp. 65-76, 1 pl.
- HOBSON (G. V.). *Barytes in Scotland, with special reference to Gasswater and Muirshiel mines*. Pp. 85-97, 2 pls.
- DUNHAM (K. C.). *Non-ferrous mining potentialities of the northern Pennines*. Pp. 115-147, 7 figs. [M.M. **22**-259; M.A. **6**-367, **14**-258]
- EASTWOOD (T.). *The Lake District mining field*. Pp. 149-174, 8 figs.
- VARVILL (W. W.). *The future of lead-zinc and fluorspar mining in Derbyshire*. Pp. 175-203, 6 figs., 3 pls. [M.A. **7**-548]
- SCHNELLMANN (G. A.). *Lead-zinc mining in the Carboniferous Limestone of North Wales*. Pp. 235-246, 4 figs.
- HUGHES (W. J.). *The lead-zinc possibilities of the Minera district, Denbighshire*. Pp. 247-250.
- ARCHER (A. A.). *The distribution of non-ferrous ores in the Lower Palaeozoic rocks of North Wales*. Pp. 259-276, 2 figs.
- HUGHES (W. J.). *The non-ferrous mining possibilities of central Wales*. Pp. 277-294, 3 figs.
- DINES (H. G.). *The west Shropshire mining field*. Pp. 295-303, 2 figs., 1 pl. [M.A. **14**-28]
- MANNING (W.). *The Parys and Mona mines in Anglesey*. Pp. 313-328, 5 figs. [M.M. **29**-63; M.A. **1**-328]
- VIPAN (P. G. L.). *Lead and zinc mining in south-west England*. Pp. 337-351, 3 figs. [M.A. **13**-223]
- HOSKING (K. F. G.) & TROUNSON (J. H.). *The mineral potential of Cornwall*. Pp. 355-369, 1 fig., 1 pl.
- TROUNSON (J. H.). *Practical considerations in developing old Cornish mines*. Pp. 371-382, 1 fig.

WEBB (J. S.). *Notes on geochemical prospecting for lead-zinc deposits in the British Isles*. Pp. 419-436, 5 figs.

The papers are each accompanied by informative and often lengthy discussions.

R. A. H.

EXPERIMENTAL MINERALOGY

GRASSELLY (GY.). *An attempt to characterize the stability relations of tetrahedral oxyanions by their complex anionic potentials*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1075-1092, 1 fig.

The complex anionic potentials are rather more suitable for a comparison of stability relations than the ionic potentials of their central cations. [M.A. 13-345]

R. A. H.

MACHIN (J. S.) & DEADMORE (D. L.). *Thermal stability of titanium dioxide*. Nature, 1961, **189**, 223-224, 1 fig.

M. J. Le B.

EVANS (P. E.) & WILDSMITH (G.). *Evidence of phase changes in zirconia from thermal etching*. Nature, 1961, **189**, 569-570, 2 figs.

In addition to the two known stable forms of zirconia, monoclinic [baddeleyite] and tetragonal, evidence is given of a hexagonal form at very high temperatures.

M. J. Le B.

BASTA (E. Z.). *Natural and synthetic titanomagnetites (the system Fe_3O_4 - Fe_2TiO_4 - $FeTiO_3$)*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1017-1048, 3 figs.

Microscopic, chemical, and X-ray investigations are reported for a number of iron-titanium minerals separated from igneous rocks. Homogeneous titanomagnetites of volcanic rocks mainly belong to the Fe_3O_4 - Fe_2TiO_4 series, with minor amounts of γ - $FeTiO_3$ in solid solution. At ordinary temperature up to 50 mol. % Fe_2TiO_4 may remain in solid solution in magnetite; the cell size increases continuously with the increase in Fe_2TiO_4 content. Heating experiments in vacuo, on ilmenite-magnetite intergrowths and on artificial mixtures, show that some interchange of ions occurs; Fe_2O_3 is partly removed from magnetite and is incorporated in ilmenite to form ferri-ilmenite, leaving an FeO-rich magnetite which combines with some FeO and TiO_2 to form titanomagnetite. Chemical analyses and cell sizes given include those for Ti-poor magnetite from spilite, Barras Nose, Tintagel, and titanomagnetites from the basalts of the Giant's Causeway, Ireland, Dunglas Hill, near Strathblane, Stirlingshire, and Blagolkot, Deccan, India, and from augitite, south of Ngong, Nairobi, Kenya. [M.M. 31-431, 32-32,778]

R. A. H.

IKENO (TERUO). *On the transition of Fe_2O_3* . Journ. Min. Soc. Japan, 1960, **4**, 435-449, 3 tables, 15 figs. (in Japanese).

Solid reactions of α - Fe_2O_3 in air were examined by the X-ray diffraction method at high temperatures and measurements were made of changes in the strength and volume of briquette. The following results have been obtained: (1) 650-1000°C, formation and completion of α - Fe_2O_3 crystals; (2) 1000-1230°C, random displacements of atoms in the α - Fe_2O_3 take place, resulting in the recombination of particles by first-step self-diffusion; (3) 1230°C, a defect lattice is formed by partial expulsion of oxygens in the lattice, and recombination of particles is advanced by second-step self-diffusion; (4) 1395°C, the α - Fe_2O_3 lattice is transformed to the Fe_3O_4 lattice of defect type with iron atom vacancies. At this stage the recombination is caused by third-step diffusion.

M. S. J.

KARKHANAVALA (M. D.). *The nature of arizonite*. Econ. Geol., 1959, **54**, 1302-1308.

A successful synthesis of arizonite ($Fe_2O_3 \cdot 3TiO_2$) was effected under hydrothermal conditions. Equilibrium was not attained and the synthetic product contained anatase, hematite, and arizonite. X-ray evidence indicates that rutile is not present. Arizonite may form by hydrothermal alteration of ilmenite rather than by atmospheric oxidation.

J. T. W.

BAUTSCH (HANS-JOACHIM). *Mineralogisch-petrographische Untersuchungen an Chrommagnetit- und Forsteritsteinen*. Freiburger Forschungshefte, 1960, C106, 75 pp., 45 figs., 18 tables. Price DM.7.

Carried out specifically for practical ends this work on refractory materials has afforded results of general interest. Examination of polished sections by reflected light allows diagnosis of components and texture by hardness, reflectivity, and habit; tables of these properties for the oxides and silicates of Ca, Mg, Fe, and Cr met in the research are given. Combination of chemical analysis and petrographical examination permits recognition of the solid solutions present. Miscibility of almost 30% exists between forsterite and monticellite, and of somewhat less amount when they are ferriiferous. Alite, C_3S , was found as a stable component with spinel. D.t.a. methods also help in distinguishing the course of the reactions. Intense orientation of forsterite crystals occurring during cooling explains

is frequent and early rectangular fracture of the bricks. Extraction of Fe, Ca, and F from the furnace gases leads to formation of glass mesostasis and magnetite crust. Addition of small amounts of alumina (bauxite) help to reduce cracking.

J. Ph.

OG (S.) & ROSENQVIST (T.). *A high-temperature manometer and the decomposition pressure of pyrite*. Trans. Faraday Soc., 1959, **55**, 1565–1569, 2 figs.

The decomposition pressure of pyrite has been measured in the temperature range 500°–552°C. In this range sulphur association pressure may be expressed by the equation:

$$P_{S_x} \text{ (atm)} = \frac{-15.733}{T} + 16.335. \text{ As the association}$$

S_2 into larger molecules is insignificant in the temperature and pressure range in question, the equation gives essentially the partial pressure of S_2 .

R. A. H.

OH (G. H.). *Experimentelle Untersuchungen an Zinnkiesen und analogen Germaniumverbindungen*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1125–1146, 3 figs., 3 pls.

Experimental syntheses in the system CuS–FeS–SnS, mostly in NaCl melts, yielded 14 phases, such as CuSnS₂ analogous to chalcopyrite, CuFeS₂, and Cu₅SnS₆ analogous to idaite, Cu₅FeS₆. In most of these compounds Sn can be replaced by Ge and Fe by Zn; the replacement of Cu by Ag is incomplete.

R. A. H.

ERNICK (J. H.). *Constitution of the AgSbS₂–PbS, AgBiS₂–PbS, and AgBiS₂–AgBiSe₂ systems*. Amer. Min., 1960, **45**, 591–598, 8 figs.

Complete series of solid solutions with the disordered NaCl-type structure exist in the pseudo-binary AgSbS₂–PbS and AgBiS₂–PbS systems. Synthetic materials corresponding to freieslebenite and diaphorite have high temperature forms with disordered NaCl structure. Only this cubic form was found for material of schirmerite composition. Negative departures from Vegard's law occur in the plot of lattice constants against composition. In both high and low temperature forms AgBiS₂ and AgBiSe₂ form complete series of solid solutions. The phase diagram is given. Lattice constants for the cubic (high temperature) phase follow Vegard's law.

L. G. B.

LLER (J.-E.) & WEGENER (W.). *Untersuchungen im System Nickel–Selen*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1147–1159, 5 figs.

In the system Ni–Se three new phases are recognized. Se_2 , space group D_{3h}^7-R32 , a 4.2375 Å, α 90°42', $Z=1$; $NiSe$, rhombohedral with millerite-type structure, a

5.8834 Å, α 116°31', $Z=3$; the phase change $\gamma \rightarrow \beta$ -NiSe takes place at about 320°C; Ni_3Se_4 , space group C_{2h}^3-C2/n , a 12.15, b 3.633, c 10.45 Å, β 149°22', $Z=2$. R. A. H.

BERDESINSKI (W.). *Synthetische Darstellung von Angelellit* $Fe^{++}_4[O_3(AsO_4)_2]$. Neues Jahrb. Min., Abhandl., 1960, **94**, 1203–1208.

The compound $2Fe_2O_3 \cdot As_2O_5$ has been synthesized by treatment of $Na_2HASO_4 \cdot 7H_2O$ and NaOH with water followed by heating to 780°–850°C for 8 to 12 hours. The product gives an X-ray powder pattern strictly comparable with that of natural angelellite [M.A. 14-343]. The synthetic angelellite decomposes at 1000°C. R. A. H.

GLASSER (F. P.). *The system Ca_2SiO_4 – Mn_2SiO_4* . Amer. Journ. Sci., 1961, **259**, 46–59, 4 figs., 2 tables.

Quenching experiments on mixtures in this system show stability fields for liquid, α - Ca_2SiO_4 solid solution [high-temperature form], α' - Ca_2SiO_4 [brédigite] s.s., olivine s.s., tephroite s.s., glaucocroite s.s., $(Ca,Mn)O$ s.s., and mixtures of these. The inversion products, β - Ca_2SiO_4 [larnite] s.s., and γ - $CaSiO_4$ s.s. indicate by microscopic habit the original crystal form (α or α') of the material. 'Manganese merwinite' could not be confirmed in this system; glaucocroite is clearly distinguished by optical and X-ray data, although the solidus curve shows no evidence of its existence.

H. W.

FYFE (W. S.). *Hydrothermal synthesis and determination of equilibrium between minerals in the subliquidus region*. Journ. Geol., 1960, **68**, 553–566, 3 figs.

Determination of equilibrium of mineral phases by synthesis has limitations that too often are not adequately taken into consideration. Thus, the synthesis of a phase does not necessarily indicate that it is the stable phase under those conditions, and it may happen that different phases are obtained from different starting materials of the same bulk composition. The length of experimental runs should in many cases be months rather than weeks or days. Studies of relative solubilities and of calorimetry give helpful information on stability limits, and every equilibrium diagram should be critically examined in the light of available thermodynamic data.

R. E. W.

WYLLIE (P. J.) & TUTTLE (O. F.). *Experimental investigation of silicate systems containing two volatile components. Part II. The effects of NH_3 and HF , in addition to H_2O on the melting temperatures of albite and granite*. Amer. Journ. Sci., 1961, **259**, 128–143, 4 figs., 2 tables.

NH_3 raises, and HF lowers the melting temperatures of the solid phase in the systems water–albite, and water–granite, as determined by quenching experiments. The

acid facilitates growth of large albite crystals, and stabilizes quartz, making the system no longer ternary, but for conditions corresponding better to natural systems, this factor may be unimportant.

H. W.

EUGSTER (HANS P.) & WRIGHT (THOMAS L.). *Synthetic hydrous boron micas*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B441-442.

Aluminium-free boron phlogopite, $\text{KMg}_3\text{BSi}_3\text{O}_{10}(\text{OH})_2$, grown at 600°C and 2000 bars, has $a\ 5.32 \pm 0.01$, $b\ 9.165 \pm 0.02$, $c\ 10.29 \pm 0.01\text{\AA}$, $\beta\ 100^\circ 10' \pm 10'$ and calculations were based on a 1M modification. X-ray powder data are given; minimum refr. ind. 1.546 and maximum 1.568, both ± 0.002 , and birefringence 0.022. Boron annite, $\text{KFe}_3\text{BSi}_3\text{O}_{10}(\text{OH})_2$, crystallizes less readily than boron phlogopite. Synthesis of boron muscovite, $\text{KAl}_2\text{BSi}_3\text{O}_{10}(\text{OH})_2$, remains uncertain. [M.A. **12**-517]

K. S.

GIBBS (G. V.), BLOSS (F. D.), & SHELL (H. R.). *Proto-amphibole, a new polytype*. Amer. Min., 1960, **45**, 974-989, 5 figs.

In the system $\text{Li}_2\text{O}-\text{MgO}-\text{MgF}_2-\text{SiO}_2$ an orthorhombic amphibole was identified as one of the phases. It has a unit cell $a\ 9.330$, $b\ 17.867$, and $c\ 5.286\text{\AA}$ (which is one-half that of anthophyllite) with a space group $Pn\bar{m}n$ or $Pn2n$. From X-ray studies and on the basis of space group $Pn\bar{m}n$ a new structure type for amphibole is proposed. The new polytype is described by the term proto-amphibole because it appears to be structurally related to the amphiboles; optical constants for Na light $\alpha\ 1.5759$, $\beta\ 1.5870$, $\gamma\ 1.5928$, and $2V\ 74^\circ$. Chemical analysis gives the following formula for the proto-amphibole: $\text{Li}_{0.64}\text{Na}_{0.05}\text{Li}_{0.48}\text{Mg}_{1.52}\text{Mg}_{5.00}\text{Si}_{7.93}\text{O}_{21.91}\text{F}_{2.09}$.

A. C. H.

STEWART (DAVID B.). *The system $\text{LiAlSiO}_4-\text{NaAlSi}_3\text{O}_8-\text{H}_2\text{O}$ at 2000 bars*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **17**, 15-30.

The system $\text{LiAlSiO}_4-\text{NaAlSi}_3\text{O}_8-\text{H}_2\text{O}$ was studied at 2000 bars H_2O pressure and at temperatures below 900°C. The solid phases observed were albite and α -eucryptite, which form an eutectic four-phase point at $725^\circ \pm 5^\circ\text{C}$ together with steam and silicate liquid containing albite and eucryptite in the ratio 82:18 and approx. 7.5% H_2O . At 4000 bars H_2O pressure, and temperature $665^\circ \pm 15^\circ\text{C}$, the ratio of the silicate components, however, does not change. No measurable substitution of Na for Li in eucryptite or Li for Na in albite could be observed. The presence of LiAlSiO_4 appears to favour higher values of the 131-131 separation.

H. M.

AMES (L. L., Jr.). *The genesis of carbonate apatites*. Econ. Geol., 1959, **54**, 829-841, 5 figs., 4 tables.

A portion of the system $\text{Na}_3\text{PO}_4-\text{CaCO}_3-\text{H}_2\text{O}$ was investigated at low temperatures. Alkaline phosphate solutions cause replacement of calcite by a carbonate-apatite of variable composition. Relative replacement rates depend on solution pH, concentration of PO_4^{3-} relative to HCO_3^- and calcite grain size. Stability relations in the system $\text{Na}_3\text{PO}_4-\text{CaCO}_3-\text{H}_2\text{O}$ indicate that apatite replacement of carbonates is the most probable origin of large marine phosphorite deposits.

W. E. H.

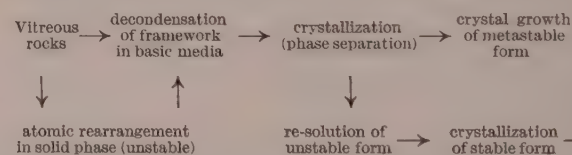
ZAMINER (C.). *Untersuchungen an Thomasschlacken*. Neue Jahrb. Min., Abhandl., 1960, **94**, 1411-1424, 4 figs.

An attempt to show the crystallization sequence in the final stages of the formation of Thomas slags is reported. The volatile components and crystallization stages are similar to those of igneous rocks. Optical properties and cell parameters are given for tetracalcium phosphates, apatite, calcium ferrite, and silicocarnotite [M.M. **28**-496]

R. A. H.

KIRIYAMA (RYOITI) & IWASAKI (HIROSHI). *Process of mineral formation from obsidian under hydrothermal conditions*. Journ. Geol. Soc. Japan, 1960, **66**, 242-250, 7 figs., 6 tables (Japanese with English summary).

Hydrothermal experiments on obsidian were carried out under various chemical conditions in the temperature range 150-300°C using Morey-type autoclaves. It is concluded that the crystallization processes from vitreous rocks in basic media under hydrothermal conditions can be explained in the following courses and branches.



The origin of clay-zeolite paragenesis in nature is also discussed on the basis of the present experiments.

M. S. J.

DE CARLI (P. S.) & JAMIESON (J. C.). *Formation of an amorphous form of quartz under shock conditions*. Journ. Chem. Phys., 1959, **31**, 1675-1676.

Quartz crystals shock-loaded to 360-600 kilobars became amorphous to X-ray diffraction, with $n\ 1.46$, $D\ 2.22\ \text{g/cm}^3$. The calculated temperature at 360 kilobars was 870°F reducing to 515°K after the shock. Coesite is the stable form under these conditions; the amorphous state is less dense and stable than coesite but more dense and stable than quartz.

W. T. H.

MAJUMDAR (A. J.) & ROY (R.). *Experimental study of the polymorphism of AgI* . Journ. Phys. Chem., 1959, **63**, 1858-1860, 2 figs.

ΔT of the transition of artificial iodargyrite from the urtztite to the high-temperature cubic forms were measured to 1000 atm; the derived ΔH is consistent with thermochemical measurements. Contrary to earlier assertions there is no range of thermodynamic stability for the endo-type structure.

W. T. H.

HASE (A. B.) & LEFEVER (R. A.). *Birefringence of synthetic garnets*. Amer. Min., 1960, **45**, 1126–1129.

A. C. H.

GEMSTONES

WINING (Lord). *A history of the crown jewels of Europe*. London (Batsford), 1960, xl+707 pp., 230 pls. Price £16 16s.

R. A. H.

WEET (J. M.) & COUPER (A. G.). *The "Colenso" diamond*. Journ. Gemmology, 1961, **8**, 84–85.

A brief historical account of the career of the largest diamond crystal in the British Museum (Natural History). It is a pale yellow octahedron with rounded edges, weighs 33.1450 carats, and was presented in 1887 by John Ruskin.

R. A. H.

KING (A. J.). *Notes on Alamasí diamond mine*. Rec. Geol. Survey Tanganyika, 1960, **8**, 63–66.

Diamonds are derived from the tuff ring of the Mwadi crater, rather than from a kimberlite body on the Alamasí property.

D. McK.

EPPLER (W. F.). *Inclusions in diamond*. Journ. Gemmology, 1961, **8**, 1–13, 24 figs.

Some of the solid inclusions found in diamonds have been separated by the expedient of burning away the diamond by heating at 915°C for six hours; they include garnet, kyanite, olivine, and apatite. Gaseous inclusions, healing fissures, and a negative crystal are also recorded. No evidence was found of the occurrence of graphite or quartz inclusions in diamond.

R. A. H.

FISCHER (R. B.). *The 'Ballas' form of diamond*. Nature, 1961, **189**, 50, 1 fig.

No radial symmetry was observed in a section through a 'ballas' diamond.

M. J. LE B.

DELARIO (A. J.). *Jade through the ages—Part I*. Rocks and Minerals, 1960, **35**, 578–582.

——— *Part II*. Op. cit., 1961, **36**, 8–14, 4 figs.

Part I includes the mineralogy of nephrite and jadeite. Important localities are reviewed along with a discussion

Two types of structures were noted: a birefringent halo around large inclusions and well-defined banding or zoning. All crystals examined showed banding birefringence. The halo associated with the large inclusions was rare. On annealing for 24 hours at 1200°C the halo birefringence decreased sharply, indicating that it may have been caused by strain developed in the crystal during cooling. The banding birefringence also decreased on annealing.

A. C. H.

of the history of jade. The influence of Chinese religions on jade carving is outlined in Part II, and attention is given to the meaning of various religious symbols engraved on jade. A bibliography of jade is given.

R. S. M.

WASKEY (FRANK H.). *Washington State jade*. Rocks and Minerals, 1961, **36**, 30–31, 1 fig.

A few localities of jade are mentioned but not described.

R. S. M.

WHITE (E. A. D.). *Synthetic gemstones*. Quarterly Reviews, 1961, **25**, 1–29, 4 figs., 5 pls.

After a review of crystallization processes, synthetic gemstones are classified according to the methods of crystal growth used, and specific syntheses are described in detail. The properties of gemstones are considered, not only with regard to distinction between natural and synthetic materials, but also from the point of view of their uses, both decorative and scientific.

J. M. H.

EPPLER (W. [F.]). [*Synthetic emeralds*]. Herbert Smith Memorial Lecture. Journ. Gemmology, 1961, **8**, 88–95, 6 figs.

The production of synthetic emerald is discussed. Two notable features of synthetic crystals are the occurrence of growth zones, and of regular intergrowths or twins. The crystal inclusions in synthetic emeralds have the same habit and properties as phenakite synthesized under similar conditions. Using a melt of acid lithium molybdate, of composition $\text{Li}_2\text{MoO}_4 \cdot 1.66 \text{ MoO}_3$, with pieces of silica glass on top, the time taken to synthesize an emerald crystal large enough to yield a 1 carat cut stone is about one year. [M.A. 14–119]

R. A. H.

GÜBELIN (E.). *Hydrothermal rubies and emerald-coated beryl*. Journ. Gemmology, 1960, **8**, 49–63, 24 figs.

Details are given of the production of synthetic ruby by

hydrothermal process using poorly crystallized gibbsite or corundum as nutrient together with sodium carbonate and a seed of ruby: a single run may take one or two months. The rubies produced vary from $\frac{3}{4}$ to $1\frac{1}{4}$ inches in size: the best colour is obtained with the addition of 1% Cr. An Austrian synthetic material called Emerita consists of a

cut or faceted poorly coloured natural beryl nucleus surrounded by a thin layer of synthetic emerald. In both cases the most reliable means of identification is by microscopic examination: natural inclusions within the core may be compared with bubbles or cracks in the outer layers.

R. A. H.

GEOCHEMISTRY

VAN LIER (J. P.), DE BRUYN (P. L.), & OVERBEEK (J. T. G.). *The solubility of quartz*. Journ. Phys. Chem., 1960, **64**, 1675-1682, 11 figs.

Solubility of quartz was measured after removal of a 300 Å disturbed surface area by washing in HF solution. Solubility in pure water is 1.09×10^{-8} mole/kg at 100°C and follows the empirical equation $\log C = 0.151 - 1162/T$ to 200°C if the correlative data by Kennedy [M.A. 9-210] are included. Extrapolation to 25°C gives 1.8×10^{-4} mole/kg. Solubility was also measured in NaOH and buffered borax solutions, and is consistent with a dissociation constant of $10^{-9.1}$ for the reaction $H_4SiO_4 = H^+ + H_3SiO_4^-$. The solubility in NaCl solution of concentration $10^{-2} N$ or lower is the same as in pure water; at $10^{-1} N$ the solubility is markedly increased, and equilibrium was not attained in the experiment. The measured reaction rate for solution is about 10^{-18} g(SiO₂)/cm²sec at 25°C, controlled by the postulated dissociation reaction rather than by diffusion either in the solution or in a boundary layer. Conversely, the rate constant for crystallization is $7 \cdot 10^{-10}$ g(soln)/cm²sec. Both solution and crystallization are accelerated several orders of magnitude by NaOH or NaCl. Standard heat, entropy, and free energy of the dissolution reaction were calculated.

W. T. H.

STSCHERBINA (W.) [SCHERBINA (V. V.)]. *Die Verteilungseigenarten einiger seltener Elemente in Mineralien einer gemeinsamen Paragenese*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1093-1100.

The geochemical behaviour of the rarer elements in mineralization sequences is studied as a function of the degree of diadochic relationship, the chemical nature of the anions, temperature and pressure, pH, differing oxidation states of certain elements, and the sulphide-oxygen equilibria.

R. A. H.

RAUPACH (M.). *Aluminium ions in aluminium hydroxide, phosphate and soil-water systems*. Nature, 1960, **188**, 1049-1050, 1 fig.

M. J. Le B.

[BOKIŬ (G. B.) & KHODASHOVA (T. S.)] Бокій (Г. Б.) & Ходашова (Т. С.). Кристаллохимия индия [*Crystal chemistry of indium*]. Мин. сборник Львов. геол. овщ. [Min. Mag. Lvov Geol. Soc.], 1959, **13**, 53-65.

Crystal chemistry of indium and certain of its compounds is described and the existence of divalent indium denied. Its geochemical behaviour is determined by its crystal chemical similarity with zinc and lead.

N. R.

MACFARLANE (R. D.). *Natural occurrence of samarium-146*. Nature, 1960, **188**, 1180-1181, 1 fig.

M. J. Le B.

VISTELIUS (ANDREW B.). *Paragenesis of sodium, potassium and uranium in volcanic rocks of Lassen Volcanic National Park, California*. Geochim. Cosmochim. Acta, 1958, **14**, 29-34, 1 fig.

Statistical analysis of J. A. S. Adams's Na₂O, K₂O, and U data [M.A. 13-498] shows that fractional differentiation explains the simultaneous concentration of Na and K but not of U and K. During magmatic evolution U migrating through the magmatic basin was kept back by the medium enriched by K, the result being simultaneous concentration of U and K without any geochemical correlation between U and Na.

R. C.

COULOMB (R.), GOLDSZTEIN (M.), & LE MERCIER (M.). *L'uranium dans quelques granites français*. Geochim. Cosmochim. Acta, 1959, **15**, 10-17, 4 figs.

The statistical distribution of U and K and the geographical abundance of U are given for a group of granites in Brittany. There is no statistical correlation between U and K.

R. C.

HAMILTON (E.). *The distribution of radioactivity in some fine-grained igneous rocks*. Geol. Mag., 1960, **97**, 255-260.

A felsite, two trachytes, an andesite, and two basalts were examined by the nuclear emulsion technique. α /cm² sec varied from 14.1 (felsite) to 1.7 (olivine basalt) and, in general, the distribution was comparable with that observed in coarser-grained types.

R. St J. L.

YAYASE (ICHIKAZU) & TSUTSUMI (TOKUDO). *On the emanating power of powdered rocks*. Mem. Coll. Sci., Univ. Kyoto, ser. B, 1958, **24**, 315–323, 6 figs., 4 tables.

The radioactivity possessed by gases emitted from pulverized rocks is termed their emanating power. This has been determined for about 40 samples of crushed rocks by a technique involving nuclear track plates by which $^{226}\text{RaC}'$ and $^{232}\text{ThC}'$ can be distinguished. The emanating power of altered or weathered rocks is much higher than that of fresh rocks. A. P.

LOCKENBAUER (W.). *Zur Geochemie des Selens in ostalpinen Erzen*. Tschermaks Min. Petr. Mitt., 1960, ser. 3, **7**, 149–185, 2 figs., 8 tables.

163 sulfide ores or sulfide ore minerals from the east Alpine region and 18 from other localities were spectroscopically examined for Se. The average Se content of east Alpine pyrites is probably about 0.0005%. Galena and complex sulfides have higher Se content; in one case, galena from Myrthengraben, Semmering, exceeded 1%. Se content decreases in the series galena–tetrahedrite–chalcopyrite–pyrite–pyrrhotine and is not primarily controlled by temperature of formation. Generally the Se content of sulfides is low in the east Alpine region, but higher values are found in the Semmering area at its eastern extremity. No correlation of Se content with other trace elements could be established. A. P.

BRANDENSTEIN (M.), JANDA (I.), & SCHROLL (E.). *Seltene Elemente in österreichischen Kohlen- und Bitumengesteinen*. Tschermaks Min. Petr. Mitt., 1960, ser. 3, **7**, 260–285, 4 tables.

119 samples of coal and other bituminous materials from Austria were spectroscopically examined for trace amounts of 20 elements. The results are given in two tables, expressed in grams per ton of ash and in grams per ton of air-dried raw material. A. P.

MUMMEL (C. L.) & CHAPMAN (ROBERT M.). *Geologic and economic significance of some geochemical results obtained from stream sediment samples near Nome, Alaska*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B30–33, 1 fig.

Content in p.p.m. of Pb, Cu, Zn, As, W, Mo, Bi, and Sb are listed and conclusions drawn on the mineralization of unexploited areas. K. S.

EBBER (G. R.). *Application of X-ray spectrometric analysis to geochemical prospecting*. Econ. Geol., 1959, **54**, 816–828, 10 figs., 1 table.

The method of X-ray spectrometry can be applied to determine the variation of metallic elements in soils and is

rapid, relatively inexpensive, and non-destructive of sample. Many elements can be detected. The accuracy of quantitative measurements depends largely on the standards available and on the method of preparation of samples. The sample may be examined as received or it may be treated by acid extraction and the solution or a concentrate from it analysed. There may be a particle size effect when raw samples are used. Examples of application to analysis for Zn, Fe, Mn, Cu, Pb, and Ni are given. W. E. H.

[MUKANOV (K. M.)] Муканов (К. М.). О некоторых особенностях образования первичных ореолов рассеяния рудных месторождений [*On certain features of the formation of primary aureoles of dispersion of ore deposits*]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-dep., Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 181–186.

Primary aureoles of hidden ore deposits are of importance in prospecting. A brief review is given concerning the aureoles of hydrothermal deposits and the zonality which is caused by the mobility of ions and the filtration effect. S. I. T.

[BUGEL'SKIĬ (YU. YU.)] Бугельский (Ю. Ю.). О возможности постановки гидрогеохимических поисков бериллия [*Possibilities of an organisation of hydrogeochemical prospecting for beryllium*]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-dep., Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 187–190. S. I. T.

[VINOGRADOV (V. I.)] Виноградов (В. И.). Некоторые вопросы гидрогеохимии молибдена [*Certain problems of the hydrogeochemistry of molybdenum*]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-dep., Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 191–204, 2 figs.

Problems discussed are: the velocity of oxidation of molybdenite, conditions of formation of ferrimolybdenite and powellite, velocity of breakdown of molybdenite deposits, aureoles of dispersion of molybdenum around molybdenum-free sulphide deposits. It is concluded that molybdenum is an easily migrating element in the hypergene zone and thus can be used for hydrogeochemical prospecting. S. I. T.

[KALITA (E. D.)] Калита (Е. Д.). К вопросу об ореолах рассеяния лития, рубидия и бериллия [*Problem of aureoles of dispersion of lithium, rubidium, and beryllium*]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-dep., Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 205–211, 3 figs.

Distribution curves for Li, Rb, and Be were constructed for traverses across a replacement-pegmatite in amphibolite. It is concluded that the most mobile elements are Li and Rb.

S. I. T.

ORÓ (J.). *Comets and the formation of biochemical compounds on the primitive earth.* Nature, 1961, **190**, 389–390.

It is suggested that trapping of comets by the Earth would lead to accumulation of relatively large amounts of

carbon compounds which are known to be spontaneously transformed into biochemical compounds. M. J. Le B.

PIRIE (N. W.). *Solar wind and terrestrial oxygen.* Nature 1961, **190**, 706.

If all the hydrogen in the ocean has been brought by the solar wind [DE TURVILLE (C. M.), Nature, 1959, **190**, 156] the oxygen in the ocean, like the oxygen of ferric iron, must be 'fossil' O, that is, derived from the original atmosphere. M. J. Le B.

HISTORY AND BIOGRAPHY

FREYBERG (BRUNO V.). *Johann Gottlob Lehmann (1719–1767). Ein Arzt, Chemiker, Metallurg, Bergmann, Mineraloge und grundlegender Geologe.* Erlanger Forschungen, Reihe B: Naturw., Bd. 1, Erlangen, 1955, 159 pp., 1 pl. (portrait).

This is a very full and very erudite account of the life and work of J. G. Lehmann. Born in Langenhennersdorf, near Pirna in Saxony, in 1719, Lehmann studied medicine in Leipzig and Wittenberg and, at first, practised as a doctor in Dresden (1741–1750), then he became a free-lance chemist and mineralogist in Berlin (1750–1761), and finally Professor of Chemistry at the Academy of Sciences in St. Petersburg (1761–1767). His field work was done mainly among the mines of the Harz and adjoining regions. Besides numerous papers on chemical subjects, minerals, and ore-deposits, Lehmann published in 1760 a book entitled 'Cadmiologia' in which he described cobalt minerals and ores, a text-book of mineralogy (two editions 1758, 1760), and a book on assaying (1761). In the field of geology Lehmann is best known as the author of a book published in Berlin in 1756 entitled 'Versuch einer Geschichte von Flötz-Gebürge, &c.' (An essay on the history of layered rocks). In this book he provided a detailed description, illustrated by geological sections, of the assemblage of strata later included in the Permian system in Germany. He published also a book on general orography (St. Petersburg, 1762). The bibliography of his published works contains 112 items, but these include reprints of his earlier works and translations. It is rather interesting to note that a number of his articles were reprinted in the German prototype of the 'Mineralogical Magazine', bearing the frivolous title of 'Mineralogische Belustigungen' (Mineralogical Amusements), the first volume of which, published in Leipzig, appeared in 1768, a year after Lehmann's death. In an appendix Dr. Freyberg gives a number of hitherto unpublished letters and notes by Lehmann. The frontispiece is a portrait of Lehmann engraved soon after his arrival in St. Petersburg in 1762.

This essay by Dr. Freyberg provides a penetrating and very full account not only of Lehmann's life and work, but also of the contemporary scientific background in Germany and in Russia, and as such it represents a very valuable contribution to the history of science. S. I. T.

[GRIGOR'EV (D. P.)] Григорьев (Д. П.). Л. Дж. Спенсер [L. J. Spencer]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1960, **89**(2), 251–253, portrait.

This is a highly appreciative obituary note on L. J. Spencer, recording him as an outstanding mineralogist as a most able editor of the Mineralogical Magazine, and the creator and promoter of the Mineralogical Abstracts which within its scope has published 2665 abstracts of Russian works during the period 1920–1958. Giving Spencer's last list of the average ages of mineralogists the author of this article remarks that Spencer himself provided a high figure for any future statistical estimate. S. I. T.

[SERDYUCHENKO (D. P.) & PLATONOVA (N. Kh.)] Сердюченко (Д. П.) и Платонова (Н. Х.). Петр Николаевич Чирвинский (1880–1955) [Petr Nikolaevich Chirvinskii (1880–1955)]. Изд. Акад. Наук СССР [Pub. Acad. Sci. U.S.S.R.], 1960, 94 pp., 1 portrait. Price 2r. 20k. (old rouble), 22k. (new rouble).

This small booklet contains an article on the life and work of P. N. Chirvinskii by D. P. Serdyuchenko and N. Kh. Platonova (pp. 3–20) and a bibliography (pp. 21–94) containing some 400 titles of books and articles written by Chirvinskii, compiled and indexed by N. V. Smirnov. Chirvinskii being very versatile published books on minerals and ore-deposits and wrote numerous articles on mineralogy, geochemistry, petrology, geology, glaciology, meteoritics and astronomy. He will be remembered by English readers as a very active contributor to "Mineralogical Abstracts" during the period 1920–1930. S. I. T.

AO (N. LEELANDA). *Proceedings of the first annual meeting of the Mineralogical Society of India*. Indian Mineralogist, 1960, **1**, no. 2, 85-87.

The Mineralogical Society of India was registered at Madras on 12th June, 1959, and the first annual session was held at Ferguson College, Poona, 28th-30th December,

1959. The President of the Society is Professor Dr. P. R. J. Naidu, Madras; the Secretary is Sri N. Leelanda Rao, Dept. of Geology and Geophysics, University of Madras. The first number of the Society's journal, The Indian Mineralogist, was published in January, 1960.

J. Ph.

MINERAL DATA

ISCHENDORF (G.). *Über Eskebornit von Tilkerode im Harz*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1169-1182, 1 fig., 3 pls.

Two optically different varieties of eskebornite occur together with chalcopyrite, tiemannite, naumannite, clausenite, and ankerite near the Eine tunnel, east of Tilkerode, Harz, Germany. Analyses of two synthetic eskebornites indicate formulae $\text{Cu}_{0.43n}\text{Fe}_{0.61n}\text{Se}_n$ and $\text{Cu}_{0.55n}\text{Fe}_{0.62n}\text{Se}_n$, leading to a general formula $(\text{Cu},\text{Fe})_{1.1n}\text{Se}_n$ with the molecular proportion Cu:Fe nearly 1:1. Despite optical anisotropy, X-ray studies indicate cubic symmetry for most of the crystals with a 5.53 Å for natural eskebornite and 5.53-5.55 Å for synthetic material; indexed X-ray powder data are tabulated.

R. A. H.

TSIGIKALOVA (T. N.) Цигикалова (Т. Н.). Об айкините из месторождения Акчагыл [On aikinite from Akchagyl deposit]. Мат. геол. руд., мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-deposits, Petr. Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 301-307, 2 figs.

Aikinite is found in chalcopyrite-blende-galena ores of the Akchagyl polymetallic deposit which occurs in Upper Silurian sedimentary rocks. Aikinite occurs as aggregates of prismatic crystals. It is colourless, average H. 4, sp.gr. 6.99; chemical analysis gave Bi 35.94, Pb 35.66, Cu 11.31, S 16.79, Fe 0.48, CaO 0.21, insol. 0.09, Mg tr., = 100.48. X-ray data are given.

S. I. T.

MASON (B.). *The identity of namaqualite with cyanotrichite*. Min. Mag., 1961, **32**, 737-738.

Re-examination of namaqualite [Church, Journ. Chem. Soc., 1870, **23**, 1] shows it to have fibrous crystals, strongly pleochroic from almost colourless to bright blue, α 1.59, γ 1.65. These properties are those of cyanotrichite; the identity of the two minerals was confirmed by an X-ray powder photograph.

R. A. H.

OMORI (KEIICHI) & HASEGAWA (SHUZO). *Chemical compositions of euxenite and ilmenite from the Ippaiyama pegmatite, Fukushima Prefecture*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1958, **42**, 280-284, 2 figs., 4 tables, (Japanese with English summary).

Ilmenite in this locality occurs as hexagonal platy crystals, associated with pinkish microcline perthite of composition $\text{Or}_{68.1}\text{Ab}_{31.4}\text{An}_{0.5}$. Chemical analysis by S. Hasegawa of ilmenite (including small quantity of unmixed hematite and titania mineral) shows: TiO_2 49.64, FeO 35.39, MnO 2.70, MgO 0.24, CaO none, Fe_2O_3 10.86, Al_2O_3 0.11, SiO_2 0.32, $\text{H}_2\text{O} +$ 0.21, $\text{H}_2\text{O} -$ 0.25, = 99.72; sp. gr. 4.710.

Euxenite occurs as dendritic or radial aggregations or spots in microcline perthite. Chemical analysis of euxenite by S. Hasegawa shows: CaO 1.45, MnO 0.18, ThO_2 1.04, $[\text{Ce}]_2\text{O}_3$ 1.62, $[\text{Y}]_2\text{O}_3$ 20.46, UO_2 1.78, UO_3 10.05, FeO 2.34, MgO 0.38, Fe_2O_3 0.96, Al_2O_3 0.21, TiO_2 25.60, Nb_2O_5 15.02, Ta_2O_5 14.78, SnO_2 0.39, SiO_2 1.18, $\text{H}_2\text{O} +$ 1.67, $\text{H}_2\text{O} -$ 0.33 = 99.44, with chemical composition of $(\text{Ca}_{0.10}\text{Mn}_{0.01}\text{Th}_{0.02}\text{Ce}_{0.04}\text{Y}_{0.54}\text{U}_{0.16}\text{Fe}^{2+}_{0.12})_{0.99}(\text{Mg}_{0.03}\text{Fe}^{3+}_{0.05}\text{Al}_{0.02}\text{Ti}_{1.20}\text{Nb}_{0.43}\text{Ta}_{0.25}\text{Si}_{0.08})_{2.06}(\text{O},\text{OH})_{6.34}$; sp. gr. 5.271.

I. S.

SCHALLER (WALDEMAR T.) & MROSE (MARY E.). *The naming of the hydrous magnesium borate minerals from Boron, California—a preliminary note*. Amer. Min., 1960, **45**, 732-734.

Inderite (monoclinic) and kurnakovite (triclinic) are dimorphs of $\text{Mg}_2\text{B}_6\text{O}_{11.15}\text{H}_2\text{O}$. 'Lesserite' [A.M. **41**-927; M.A. **13**-303] is identical with type inderite [M.A. **7**-121-3; A.M. **23**-294]. The 'inderite' described from Boron, California [A.M. **31**-71, **41**-839; M.A. **9**-310] is kurnakovite [M.A. **8**-53; A.M. **26**-293].

A. C. H.

[PERTSEV (N. N.) & NIKITINA (I. B.)] Перцев (Н. Н.) и Никитина (И. Б.). Флюоборит из Южной Якутии [Fluoroborite from southern Yakutia]. Мат. геол. руд., мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-deposits, Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 308-310.

Fluoroborite was found in a bore-hole core in an ore-bearing magnesian skarn, in association with phlogopite and magnetite. It occurs in the form of hexagonal plates, of a lilac or pinkish-grey colour, sp.gr. 2.947, ϵ 1.508, ω 1.530. Chemical analysis gave B_2O_3 17.38, MgO 63.20, $\text{H}_2\text{O} +$ 3.41, F 22.73, Al_2O_3 , SiO_2 , TiO_2 etc. 2.51, = 109.23, -O for F_2 -9.97, = 99.26. X-ray data are given. [M.M. **29**-637; M.A. **11**-424.]

S. I. T.

BARIC (LJ.). *Gajit, ein Gemenge von Calcit und Brucit*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1200–1202.

Gajite, described by F. Tučan (1911) as a new mineral, is shown by optical, chemical, and X-ray studies to be a mixture of calcite and brucite in the approximate ratio 2 : 1. [M.M. 16–361]. R. A. H.

[ERMILOVA (L. P.) & SENDEROVA (V. M.)] Ермилова (Л. П.) и Сендерова (В. М.). О стронцианите из Западного Караобинского месторождения в Центральном Казахстане [On a strontianite from the western Karaobinsky deposit in Central Kazakhstan]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-dep., Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 294–300, 4 figs.

Strontianite is found in marmorized contact limestones of Devonian age penetrated by quartz veins carrying wolframite and molybdenite. Strontianite occurs in radial aggregates, white or pinkish coloured, sp.gr. 3·658; biaxial, 2V very small (almost uniaxial), α 1·519, γ 1·670. Chemical analysis gave CaO 5·95, SrO 61·73, MgO 0·07, BaO 0·26, R₂O₃ 0·16, SiO₂ 0·40, F 0·34, SO₃ 1·42, CO₂ 29·34, = 99·67, –0 for F 0·14, = 99·53. S. I. T.

DIETRICH (R. V.). *Calciostromianite from Pulaski and Rockingham counties, Virginia*. Amer. Min., 1960, **45**, 1119–1124, 2 figs.

Calciostromianite [emmonite] occurs in calcite-lined vugs in limestone as spear-shaped crystals forming radiating groups. The Pulaski County material has α 1·522, γ 1·664, 2V α 8°, dispersion slight with $r < v$. D.t.a. showed endothermic peaks at 860° and 925°C. X-ray powder data are listed; the strongest reflections are at 3·51 (vvs), 3·41 (vs), 2·43 (vs), 2·54 (s), and 2·04 Å (s). The mineral showed white fluorescence with both long and short waves. A. C. H.

KAWAI (TEIKICHI). *Chemical studies on minerals containing rare elements in the Far East* (Rept. 51). *Gadolinite from Fusamata, Kawamata-machi, Fukushima Prefecture*. Journ. Chem. Soc. Japan (Pure Chem. Sect.), 1960, **81**, 1054–1055, 4 tables, (in Japanese).

A greenish black mineral was found in pegmatite at Fusamata. X-ray powder lines of the mineral show good agreement with those of gadolinite. Chemical analysis by the author gave BeO 3·12, MgO 0·71, CaO 3·98, MnO 1·34, FeO 11·45, Al₂O₃ 0·52, Fe₂O₃ 4·36, Ce₂O₃ 1·52, Σ Y₂O₃ 50·13, ThO₂ 0·45, SiO₂ 21·30, (Nb,Ta)₂O₅ 0·00, H₂O 0·58, = 99·46. The distribution of rare-earth elements belongs to the thalenite type. The contents of trivalent metals, except Be, are larger than those of typical gadolinite. M. S. J.

KATO (TOSHIO). *Uranothorite from Naégi, Gifu Prefecture*. Min. Journ. (Japan), 1960, **3**, 90–95, 2 tables.

Uranothorite from Naégi, Gifu Prefecture, Japan, occurs as small grains in placers. Colour yellowish or reddish brown; sp.gr. 4·30; n about 1·68. Chemical analysis of the specimen from Nameri, Kitsumizawa, Naégi, by the author gave CaO 1·16, PbO 0·98, Al₂O₃ 1·84, Fe₂O₃ 2·54, Ce₂O₃, etc. 1·89, ThO₂ 58·17, UO₂ 9·05, SnO₂ 0·26, TiO₂ 0·05, SiO₂ 11·89, P₂O₅ 0·59, H₂O + 7·10, H₂O – 4·98, = 100·47. X-ray fluorometric analysis shows the presence of rare earths of Ce, La, Nd, Sm, Gd, Dy, Er, and Y. X-ray powder data suggest that the specimen is metamictized thorite or uranothorite. D.t.a. data and infrared absorption data are also presented. The writer considers that the specimen is an intermediate member of the uranothorite–thorogummite series, having the chemical composition of (R⁴⁺R³⁺R²⁺)_{0·9} [Si₁P(O,OH)₄]_{1–0·44} (OH)_{1+0·44} 0·8H₂O. M. S. J.

WIEDEN (PAUL). *Ein eisenarmer Nontronit*. Tschermarks Min. Petr. Mitt., 1960, ser. **3**, **7**, 186–199, 5 figs.

An iron-poor nontronite makes up a lump in sandy sediments penetrated by a well boring at 35 meters at Mariasdorf, Burgenland, Austria. On air-dry material α = 1·520, γ = 1·546, γ – α 0·026. Chemical analysis gives SiO₂ 51·34, Al₂O₃ 22·75, Fe₂O₃ 11·97, FeO 0·04, MgO 1·52, CaO 2·19, K₂O 0·54, Na₂O 0·09, H₂O + 9·56, = 100·00. Electron micrographs reveal tubular structure; d.t.a. and infrared absorption curves, and an X-ray powder diffraction pattern are presented. Basal spacings are:—13·5 Å dried at 110°C, 14·09 air-dried, 14·73 water-saturated. The formula calculated according to Ross and Hendricks is Ca_{0·34}(Al_{1·24}Fe^{III}_{0·61}Mg_{0·15})(Si_{3·44}Al_{0·56}O₁₀)(OH)₂. Spectroscopic examination gave indications of the presence of 12 minor constituents, Ba, the highest, 0·1%. A. P.

KRAUSE (H.). *Über Lievrit aus dem Huttal bei Clausthal*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1277–1283, 4 figs.

Lievrite [ilvaite] from the diabase contact at Huttal near Clausthal, in the Harz mountains, has sp.gr. 4·02 and contains trace amounts of Mg, Al, Zn, Be, and P. X-ray powder data are tabulated and compared with those for lievrite from Seriphos, Greece, and goethite from Cornwall. The infrared spectrum of lievrite is comparable with that for a sorosilicate rather than a nesosilicate. R. A. H.

KNORRING (O. VON) & HORNING (G.). *On the lithium amphibole holmquistite, from Benson pegmatite mine, Mtoko, Southern Rhodesia*. Min. Mag., 1961, **32**, 731–735 & 823, 1 fig.

Holmquistite occurs in amphibolite at the contact with

spodumene-lepidolite pegmatite at the Benson claims (7° 2'S., 32° 15'E.), in the Mtoko-Fungwe area, north-eastern Southern Rhodesia. The holmquistite-bearing rock extends over an area of at least 80 by 20 feet; it is bluish grey and contains jacaranda-blue holmquistite crystals up to 5 mm in length. Chemical analyses, by O. von Norrning, of the holmquistite gave SiO_2 59.06, TiO_2 0.20, Fe_2O_3 12.38, FeO 2.36, FeO 10.84, MnO 0.25, MgO 8.82, CaO 0.21, Na_2O 0.11, K_2O 0.05, Li_2O 3.33, $\text{H}_2\text{O} +$ 2.09, $\text{H}_2\text{O} -$ 0.07, F 0.18, (less $\text{O} = \text{F}$ 0.08), = 99.87, and of the associated hornblende SiO_2 44.06, TiO_2 0.97, Al_2O_3 12.84, Fe_2O_3 3.70, FeO 14.40, MnO 0.25, MgO 8.74, CaO 11.04, Na_2O 1.72, K_2O 0.31, Li_2O 0.15, $\text{H}_2\text{O} +$ 1.81, $\text{H}_2\text{O} -$ 0.16, = 100.15. The holmquistite has α 1.624, β 1.644, γ 1.651; V_α 52°; pleochroism α pale yellow, β pink-violet, γ pale purple; sp.gr. 3.09. [M.A. 4-526, 10-70, 14-138, and following abstract] R. A. H.

BARPOFF (BORIS). *Holmquistite occurrences in the mining property of Quebec Lithium Corporation, Barraute*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 17, 7-14, 4 figs., 1 pl.

In the Lacorne area, Province of Quebec, Canada, holmquistite has been found mostly in hornblendite or granodiorite at or close to the contact with pegmatite dykes in which the Li content is low [0.14 average of two values]. The holmquistite forms columnar, lamellar, or fibrous, sometimes asbestiform, aggregates of light blue to dark violet colour. Chemical analysis by J. A. Maxwell gave SiO_2 59.73, TiO_2 0.17, Al_2O_3 11.21, Fe_2O_3 2.97, FeO 8.92, MnO 0.20, MgO 10.16, CaO 0.56, Na_2O 0.18, K_2O 0.15, Li_2O 3.56, ign. loss 2.08, $\text{H}_2\text{O} -$ 0.02, F 0.24, = 100.15, corresponding to a formula $\text{Li}_{2.06}(\text{Mg}, \text{Fe}^{II})_{3.02}\text{Al}_{2.07}\text{Si}_{7.92}(\text{F}, \text{OH})_{24}$. By single crystal X-ray examination holmquistite is orthorhombic, the crystal structure being that of orthophyllite rather than of glaucophane; α ($\parallel b$, colourless) 1.622, β ($\parallel a$, violet) 1.646, γ ($\parallel c$, violet) 1.650, $\gamma - \alpha$ 0.028, V_α 49°. X-ray powder spacings are listed; the strongest reflections are at 8.16 (100), 2.99 (100), 4.40 (90), 3.61 Å (0). [Preceding abstract] H. M.

ÅRTENSSON (C.). *Euklas und Bertrandit aus dem Feldspatpegmatit von Kolsva in Schweden*. Neues Jahrb. Min., Abhandl., 1960, 94, 1248-1252, 2 pls.

Eucrase and bertrandite occur as alteration products of orthopyroxene associated with chrysoberyl, phenakite, and gadolinite in pegmatite 3.5 km SSW of Kolsva, Västmanland, Sweden. The eucrase has α 1.652, β 1.661, γ 1.670, 2V 50°; sp.gr. 3.05; H. 8; and for the bertrandite γ 1.654, 2V 109°; sp.gr. 2.63; H. \approx 6. Two chemical analyses and X-ray powder data are tabulated for both eucrase and bertrandite. R. A. H.

[SMOLYANINOVA (N. N.) & MOLEVA (V. A.)] Смолянинова (Н. Н.) и Молева (В. А.). Находка бавенита в скарных месторождения Батыстау (Центральный Казахстан) [A find of bavenite in skarns of the deposit of Batystau (Central Kazakhstan)]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-dep., Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 275-278.

Bavenite is found in a garnet skarn of a copper-lead-zinc deposit. It is a finely fibrous white mineral with silky lustre: α 1.583, β 1.586, γ 1.590, 2V+, elongation negative. Chemical analysis gave SiO_2 42.20, Al_2O_3 7.00, Fe_2O_3 12.30, BeO 4.00, CaO 24.30, ign. loss 11.70, = 101.50, corresponding approximately to $\text{Ca}_4\text{Be}_2\text{Al}_2\text{Si}_9\text{O}_{26}(\text{OH})$. S. I. T.

TENNYSON (C.). *Berylliummineralien und ihre pegmatitische Paragenese in den Graniten von Tittling/Bayerischer Wald*. Neues Jahrb. Min., Abhandl., 1960, 94, 1253-1265, 6 figs.

The relatively rare Be minerals milarite, bityite, and bavenite, and also stilbite, laumontite, chabazite, heulandite, monazite, apatite, samarskite, zircon, and sphene are reported from pegmatitic veins and druses in the granites of Tittling, Bavaria. The bavenite has α 1.583, β 1.585, γ 1.591; a 9.69, b 11.55, c 4.96 Å [M.M. 25-495, 32-577; M.A. 5-474, and preceding abstract]. Stilbite α 1.493, $\beta \approx$ 1.502, γ 1.511; a 13.63, b 18.20, c 11.31 Å. Heulandite α 1.503, β 1.504, γ 1.508. Laumontite α 1.506, β 1.514, γ 1.516, rising after a short time to α 1.511, β 1.522, γ 1.524; a 14.89, b 13.18, c 7.59, β 111° 30' [M.A. 12-170]. X-ray powder data are tabulated for the bavenite and laumontite: armenite from Armengrube, Kongsberg, Norway, has a 10.69, c 13.90 Å. R. A. H.

NAYAK (V. K.). *Juddite from Kajlidongri manganese mine, Jhabua District, Madhya Pradesh, India*. Min. Mag., 1961, 32, 736-737.

Juddite occurs at the Kajlidongri mine associated with blanfordite, calcite, and biotite. It has α 1.569, γ 1.681; 2V γ 66°-72°; α : [001] 21°-33°; pleochroism α light carmine to deep carmine, β colourless to pale blue with a tinge of violet, γ light pinkish orange to orange, $\alpha > \beta > \gamma$. [M.M. 30-636; M.A. 14-149] R. A. H.

KLEBER (W.) & PASCAL (I.). *Über das Achtaragdite-Problem*. Neues Jahrb. Min., Abhandl., 1960, 94, 1266-1276, 4 figs.

Achtaragdite, found by Laksman in 1783 in the sound of the Achtaragda [Akhtaragda] river, Siberia, is a pseudomorph after a cubic mineral of symmetry class $\bar{4}3m$ or 23, with dominant tristetrahedron {211}. The pseudomorph

consists of an aggregate of grossular (n 1.735), kaolinite, clinocllore (mean n 1.575), pennine (mean n 1.570), and dolomite. [M.A. 12-579]

R. A. H.

[SLIVKO (M. M.)] СЛИВКО (М. М.). О мanganцевых турмалинах [On manganiferous tourmalines]. Мин. сборн. Львов. геол. общ. [Min. Mag. Lvov Geol. Soc.], 1959, **13**, 139-148, 3 figs.

The role of manganese in tourmalines is discussed. It is concluded that the series schorlite-elbaite[rubellite]-tsilaite is continuous, whereas there is an immiscibility gap between dravite and tsilaite. In tourmalines manganese is present as Mn^{2+} or Mn^{3+} , but only the latter ion imparts a rose colour to the mineral. Chemical analyses are given for rubellite (A), brown tsilaite (B), green tsilaite (C), schorlite (D), and dravite (E):

	SiO ₂	TiO ₂	B ₂ O ₃	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO
A	37.34	0.02	10.80	43.70	0.08	0.04	0.54	0.26	0.29
B	35.79	—	10.22	40.06	0.61	—	5.85	0.19	0.90
C	35.61	0.13	10.04	38.64	0.79	0.33	4.52	0.61	0.85
D	33.78	0.41	10.70	33.80	0.20	15.11	0.25	0.74	0.21
E	37.38	1.19	10.73	27.79	0.16	0.64	—	14.09	2.78

	Na ₂ O	K ₂ O	Li ₂ O	H ₂ O+	H ₂ O-	F	-F≡O	Total
A	2.41	0.15	1.43	2.12	—	0.88	0.37	99.69
B	1.22	0.10	0.18	3.81	—	0.90	0.37	99.46
C	3.30	0.42	0.30	3.53	—	0.76	0.30	99.53
D	1.92	0.11	—	2.22	0.19	0.98	0.41	100.21
E	1.72	0.16	—	3.83	—	—	—	100.41

N. R.

KAWAI (TEIKICHI). *Chemical studies on minerals containing rare elements from the Far East* (Rept. 49). Ilmenorutile from Uzumine, Sukagawa-shi, Fukushima Prefecture. Journ. Chem. Soc. Japan (Pure Chem. Sect.), 1960, **81**, 1052, 3 tables, (in Japanese).

Ilmenorutile was found in pegmatite at Uzumine, associated with monazite, samarskite, and euxenite; sp.gr. 4.3. Chemical analysis by the author shows: MgO 2.34, CaO 1.52, MnO 15.96, FeO 19.12, Al₂O₃ 5.12, TiO₂ 37.10, (Nb,Ta)₂O₅ 15.43, SiO₂ 2.27, H₂O 0.87, = '99.82'. The mineral is characterized by larger content of Mn and is considered to be a solid solution between manganomossite and rutile, a mangano-ilmenorutile. X-ray powder lines show good agreement with those of ilmenorutile.

M. S. J.

HEINRICH (E. WM.). *Stibiotantalite from the Brown Derby No. 1 pegmatite, Colorado*. Amer. Min., 1960, **45**, 728-731.

Stibiotantalite was found on the dumps in blocks of pegmatite as crystal fragments up to $5 \times 3\frac{1}{2} \times 2\frac{1}{2}$ cm. X-ray fluorescence, semiquantitative analysis gave Ta₂O₅ 48.8, Nb₂O₅ 8.6, Sb₂O₃ 42.6, Bi₂O₃ nil, PbO 0.06, R.E. nil, (value for Sb₂O₃ by difference). The mineral is yellowish steel gray, H. 5.0, sp.gr. 7.3; good {010}, fair {100} cleavages;

refr. ind. > 2.00, $\gamma-\alpha$ 0.08, $2V_{\gamma}$ 75°, $r < v$ strong; in reflected light light grey, strong yellow internal reflection; moderately anisotropic. X-ray powder diffraction data are listed; strongest lines are 3.10 \AA s, 2.94 ms , 1.73 ms . J. Ph.

OMORI (KEIICHI), HASEGAWA (SHUZO), & KONNO (HIROSHI). *Euxenite from the Uzumine pegmatite mine, Fukushima Prefecture*. Journ. Japanese Assoc. Min. Petr. Econ. Geol., 1958, **42**, 256-260, 1 fig., 3 tables (Japanese with English summary).

Tabular, lenticular or massive euxenite occurs in feldspar in pegmatite at the Uzumine mine, Japan; sp.gr. $15\frac{1}{4}$ 5.47. Chemical analyses of the mineral by Hasegawa (A) and Konno (B) are as follows:

	CaO	MnO	ThO ₂	[Ce]O ₂	[Y]O ₂	UO ₂	UO ₃	FeO	MgO	Fe ₂ O ₃
A	0.65	0.54	1.06	0.20	19.86	11.18	0.32	2.60	tr.	4.8
B	0.96	0.77	0.90	0.50	18.87	11.47	0.51	(2.60)	0.43	5.1

	Al ₂ O ₃	TiO ₂	Nb ₂ O ₅	Ta ₂ O ₅	SnO ₂	SiO ₂	H ₂ O+	H ₂ O-	Total
A	0.16	13.73	26.68	16.14	0.32	0.48	0.88	0.21	99.81
B	0.12	14.18	25.92	15.87	0.38	0.42	(0.88)	(0.21)	(100.11)

Experimental formula of the mineral is: $X = Ca + Mn + Th + Ce + Y + U + Fe^{2+} = 258$, $Z = Mg + Fe^{3+} + Al + Ti + Nb + Ta + Sn + Si = 519$, $(O,OH) = 1577$, giving $X:Z(O,OH) = 1.00:2.01:6.11$. I. S.

NEVES (J. M. CORREIA). *Bermanite de Mangualde (Portugal)*. Memórias e Notícias, Publ. Mus. Lab. Min. Geol., Univ. Coimbra, 1958, **45**, 1-4, 2 figs., 2 tables (summaries in English and French).

Bermanite occurs as a supergene alteration product of lithiophilite and triplite in the Mn-Li pegmatites of the Mangualde area [M.M. 31-819]. It is orthorhombic, tabular of {001}, with $a:b = 0.689:1$. The mineral is pleochroic with brown ($\parallel c$) 1.685, β light brown ($\parallel b$) < 1.744, γ dark brown ($\parallel a$) slightly > 1.744, $\gamma-\alpha > 0.059$; a 6.1, b 8.93, c 19.26 Å. Indexed X-ray data are listed, the strongest lines being d (Å), 9.62 (100), 5.08 (80), 2.915 (60), 3.270 (50). J. Ph.

VAN TASSEL (R.). *La minyulite de Blaton, Hainaut*. Bul. Inst. roy. Sci. nat. Belgique, 1960, **36**, no. 50, 4 pp.

Minyulite [M.A. 12-516] occurs on Visean shales and phthanites in Belgium as fine silky fibers, ranging 60 to 300 μ , often grouped together in radiating rosettes (1 to 3 mm) α 1.531, γ 1.537. X-ray powder data are tabulated. Associated minerals are allophane-evansite, destinezite, crandallite, amorphous unidentified iron phosphates, and jarosite. [M.A. 13-371] J. M.

NEVES (J. M. CORREIA). *Piromorite de Quinzo-Dam (Angola)*. Mem. & Not., Publ. Mus. Lab. Min. Geol. Univ. Coimbra, 1958, **45**, 5-9, 1 fig., 1 pl., 1 table (summaries in English and French).

The mineral occurs as aggregates of parallel hexagonal crystals showing the forms {0001}, {10 $\bar{1}$ 0}, and a pyramid possibly {10 $\bar{1}$ 1}. Indexed X-ray data are listed. X-ray fluorescence study showed Fe, Zr, Au or Hg, Ta, Cu, Dy, and tr. Mn and Ca, in addition to lead; unidentified lines were observed at 2θ 14.12° and 28.35°.

J. Ph.

СРЕБРОДОЛ'СКИЙ (В. И.) Сребродольский (Б. И.). Ярозит из окрестностей синяка в закарпатье [*Jarosite from the neighbourhood of Sinyak in the Transcarpathians*]. Мин. сборн. Львов. геол. общ. [Min. Mag. Lvov Geol. Soc.], 1959, **13**, 403–408, 4 figs.

Encrustations of jarosite from hydrothermally altered andesites and andesitic tuffs are described. Chemical analyses are given as Al_2O_3 2.00, Fe_2O_3 41.97, FeO 0.79, HgO 0.65, MnO 0.07, CaO 1.40, K_2O 4.70, Na_2O 1.80, SO_3 8.17, H_2O 9.00, insol. res. 10.20%, [=100.75];

$\alpha = 1.716 \pm 0.002$. D.t.a. curves are provided and the size of unit cell measured: c 17.150 \pm 0.016 Å, a 14.247 \pm 0.026 Å. The formation of jarosite is associated with the oxidation of pyrite.

N. R.

GOLDING (H. G.), BAYLISS (P.), & TRUEMAN (N.). *Dehydration and rehydration of ferrimolybdate from Louther, New South Wales*. Amer. Min., 1960, **45**, 1111–1113, 1 fig.

X-ray studies show that the bright yellow, crystallized ferrimolybdate as collected was fully hydrated and suffered no change during storage at normal conditions of summer temperature and humidity. A sample partially dehydrated by desiccating over H_2SO_4 for 50 hours was restored to the fully hydrated condition by being humidified over water for 100 hours.

A. C. H.

NEW MINERALS

TRUNZ (H.). 'Chromrutit' von der Red Ledge Mine ist kein Rutil. Redledgeit. Neues Jahrb. Min., Monatshefte, 1961, 107–111, 1 fig.

Re-investigation of the type material of chromrutile M.M. 21–561 from Red Ledge Mine, Nevada County, California, showed it to have a 20.32, c 5.84 Å; space group $I_{2h}^0 - I4_1/a$; sp.gr. 3.72. Recalculation of the original analysis gives a formula $\text{Ca}_{0.70}\text{Mg}_{7.06}\text{Cr}_{11.27}\text{Fe}^{3+}_{0.52}\text{Al}_{0.53}\text{Ti}_{44.99}\text{Si}_{4.75}\text{H}_{8.47}\text{O}_{130}$, approximating to $\text{Mg}_8\text{Cr}_{12}\text{Ti}_{48}\text{Si}_4\text{O}_{130}$ assuming a diadochic substitution of TiO_4 by $(\text{OH})_4$ or of Ti by AlH. The mineral is thus considered to be a new species, and is named *redledgeite* after the locality. The indexed X-ray powder pattern is tabulated; strongest reflections occur at 3.199 (10), 2.454 (8), and 1.583 Å (8).

R. A. H.

NEIVA (J. M. COTELO) & NEVES (J. M. CORREIA). *Pegmatites of Alto-Ligonha (Mozambique-Portuguese East Africa)*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **17**, 53–62.

Granite pegmatites in the region of Alto-Ligonha, province of Zambézia in the north of Mozambique, are worked for tantalite-columbite, stibiotantalite, beryl, tourmaline, samarskite, monazite, lepidolite, muscovite, and bismuth. Among 33 minerals of the Muiane pegmatite, briefly described, are a new mineral, *mozambikite*, and two not yet identified. The composition, 'under reservations', of the new mineral is U_3O_8 6.04, SiO_2 11.00, ThO_2 58.80, Al_2O_3 4.40, Fe_2O_3 0.22, Rare Earths (R_2O_3) 8.60, CaO 0.59, H_2O 5.33, [= 94.98]; X-ray spectrographic examination shows that Zr and Y are also important. It is isotropic

with refr. ind. <1.735 but not constant throughout the mass, ranging frequently from 1.690 to 1.703; after heating to 1000°C $n_{\text{Na}} = 1.811$. The mineral contains lamellar inclusions of lepidolite. Results of further study will be published. Mineral A is probably a tantalite of the aeschynite group; it is black, with resinous lustre, orthorhombic with the more intense X-ray powder lines at 2.495 (10), 1.470 (10), 2.060 (4), 1.675 (3), 1.600 Å (3). Mineral B is black, probably orthorhombic, presumably a tantalite-columbite but its X-ray pattern is different; the most intense lines are 2.72 (10), 4.20 (6), 1.70 (5), 1.458 Å (5). The sequence of formation of the pegmatite minerals is deduced from intergrowth and overgrowth relationships. Samarskite is worked in the pegmatites of Ingela and Mirrucué. In the pegmatite of Mocachaia occur yellow-brown, octahedral pyrochlore and a black, octahedral mineral with a 8.18 Å, space group probably $Oh1-P45$. [A.M. **45**–1316]

H. M.

ABELADO (M. JIMÉNEZ DE), BENYACAR (MARÍA RODRIGUEZ DE), & GALLONI (ERNESTO E.). *Ranquillite, a calcium uranyl silicate*. Amer. Min., 1960, **45**, 1078–1086, 4 figs., 3 tables.

Ranquillite, with probable formula $1.5\text{CaO} \cdot 2\text{UO}_3 \cdot 5\text{SiO}_2 \cdot 12\text{H}_2\text{O}$, is orthorhombic with a 17.64, b 14.28, c 14.48 Å; mean refr. ind. 1.564, the fine grain precluding other measurements; sp.gr. between 2.89 and 3.32; sp.gr. (calc. for $Z = 8$) 3.32. Dehydration studies indicate the presence of two differently hydrated forms in natural ranquillite. X-ray powder data are listed for the natural mineral and for the more hydrated form. Ranquillite is associated with

gypsum; chemical analysis, corrected for gypsum content, is SiO_2 26.6, U_3O_8 46.8, CaO 6.9, H_2O 19.6, = 99.9. In dehydration-rehydration behaviour, the mineral is similar to zeunerite; in X-ray diffraction pattern and chemical composition it is closely related to haiweeite [M.A. 14-415]

A. C. H.

SØRENSEN (HENNING). *Beryllium minerals in a pegmatite in the nepheline syenites of Ilmaussaq, South West Greenland*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 17, 31-35.

In cross-cutting albite pegmatites in naujaite, chkalovite and a new beryllium mineral, provisionally termed *beryllium sodalite* have been found. The chkalovite has α 1.548, β 1.550, γ 1.552, $\gamma-\alpha$ 0.004, $2V_\gamma$ 81°, and the best cleavage perpendicular to β . The beryllium sodalite occurs in white, saccharoidal veins in the chkalovite; it consists mainly of Si, Al, Be, Mg, Ca, and Na. It is tetragonal with a 8.583, c 8.817 Å, optically uniaxial positive with ω 1.496, ϵ 1.502, $\epsilon-\omega$ 0.006, and has distinct (111) cleavage. The X-ray powder photograph shows great similarity to that of sodalite. The associated minerals are poor in Be. Detailed descriptions of the minerals are to be published later. [A.M. 46-241]

H. M.

[VLASOV (K. A.), KUZ'MENKO (M. V.), & ES'KOVA (E. M.)]

Власов (К. А.) Кузьменко (М. В.) и Еськова (Е. М.). Ловозерский щелочной массив (породы, пегматиты, минералогия, геохимия и генезис [*Lovozero alkaline massif (rocks, pegmatites, mineralogy, geochemistry, and genesis)*]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1959, 623 pp., 255 figs.

This work, which will be summarized in a following number, contains the description (pp. 427-429) of a new mineral *hydrocerite* which is found in a natrolite-albite pegmatite vein and was originally mistaken for erikite. Its colour is yellow to honey-yellow, lustre vitreous; brittle; isotropic, ? cubic, X-ray amorphous, n 1.580. Analysis by M. E. Kazakova gave SiO_2 22.30, P_2O_5 5.76, BeO 0.30, Al_2O_3 3.66, TiO_2 3.33, ZrO_2 0.49, Nb_2O_5 2.00, Fe_2O_3 6.15, MgO 0.14, CaO 2.83, Ce_2O_3 4.83, $\Sigma\text{La}_2\text{O}_3$ 12.33, ThO 15.14, $\text{H}_2\text{O} +$ 5.65, $\text{H}_2\text{O} -$ 14.14, = 99.05, giving the formula $(\text{La,Ce,Th})_2(\text{Si,P})_2\text{O}_7 \cdot 5\text{H}_2\text{O}$. [A.M. 45-1132].

S. I. T.

KAWAI (TEIKICHI). *Chemical studies on minerals containing rare elements in the Far East (Rept. 50). Fergusonite-like mineral from Uzumine, Sukagawa-shi, Fukushima Prefecture*. Journ. Chem. Soc. Japan (Pure Chem. Sect.), 1960, 81, 1053, 2 tables, (in Japanese).

A fergusonite-like mineral was found in pegmatite at

Uzumine. It is strongly radioactive; sp.gr. 5.5; X-ray powder lines are slightly different from those of heated fergusonite, euxenite, or samarskite. Chemical analysis by the author shows; MgO 4.55, CaO 3.97, FeO 4.20, Al_2O_3 2.57, $\Sigma\text{Y}_2\text{O}_3$ 17.92, Ce_2O_3 0.40, ThO_2 1.44, SnO_2 etc. 0.43, TiO_2 7.83, UO_2 11.46, UO_3 0.53, $(\text{Nb,Ta})_2\text{O}_5$ 41.76, SiO_2 1.69, H_2O 2.07, = 100.82. The distribution of lanthanid elements belongs to the thalenite type. Assuming that the uranium comes from the uraninite inclusions, the chemical formula of the mineral is determined to be $\text{ABO}_{3.4}$. It is considered that the mineral is *titaniferous fergusonite*.

M. S. J.

KAWAI (TEIKICHI). *Chemical studies on minerals containing rare elements from the Far East (Rept. 48). A mineral similar to ishikawaite and belonging to the samarskite series, from Iriyama, Ishikawa-machi, Fukushima Prefecture*. Journ. Chem. Soc. Japan (Pure Chem. Sect.), 1960, 81, 1049-1051, 6 tables, (in Japanese).

A brownish black, samarskite-like mineral was found in pegmatite at Iriyama. Its sp.gr. is 5.8. X-ray study shows the mineral to be metamict. After heating for about three hours, diffraction lines similar to those of heated samarskite or euxenite were obtained. Chemical analysis by the author shows; MgO 0.70, CaO 0.00, MnO 1.10, FeO 12.17, $\Sigma\text{Y}_2\text{O}_3$ 7.21, CeO_2 0.00, ThO_2 0.00, TiO_2 0.68, SnO_2 0.00, UO_2 23.14, UO_3 5.15, $(\text{Nb,Ta})_2\text{O}_5$ 49.35, H_2O 1.11, = 100.61. The ratio of U/Σ rare-earth elements is larger than that of samarskite or ishikawaite, and the mineral is considered to be a uranium-rich member of the samarskite-ishikawaite series.

M. S. J.

DU FRESNE (E. R.) & ROY (S. K.). *A new phosphate mineral from the Springwater pallasite*. Geochim. Cosmochim. Acta, 1961, 24, 198-205, 4 figs.

A new phosphate mineral, *farringtonite*, is described from the pallasite meteorite [M.A. 5-157] from Springwater, 100 miles west of Saskatoon, Saskatchewan. It superficially resembles olivine with which it is associated, but forms intergranular patches between the olivine nodules. It is monoclinic with α 1.540, β 1.544, γ 1.559, $2V_\gamma$ 54°-55°; $\gamma:c$ 16°-17°; O.A.P. || (010); colourless to pale yellow; fair to good (100) and (010) cleavage, parting on (100); sp.gr. \approx 2.80. Spectrographic analysis gave P_2O_5 49.7, MgO 41.6, SiO_2 2.9, FeO 3.7, leading to the ideal formula $\text{Mg}_3(\text{PO}_4)_2$; SiO_2 , FeO , and excess MgO may be in solid solution in the phosphate. The X-ray powder pattern has strongest reflections at 3.83, 3.41, and 2.39 Å. The name is in honour of Dr. O. C. Farrington (1864-1933) who established the meteorite collection of what is now the Chicago Natural History Museum.

R. A. H.

TRUNZ (H.). *Stranskiit, ein neues Mineral*. Naturwiss., 1960, p. 376, 1 fig.

A new arsenate mineral occurring in sky-blue radiating crystals with a high lustre, in association with chalcocite, at 1000 m depth in the Tsumeb mine, South-West Africa, is given the name *stranskiite* in honour of Professor I. N.

Stranski of Berlin. It is triclinic with a 5.07, b 6.77, c 5.28 Å, α 111°, β 113.5°, γ 86°; H. 4; sp.gr. 5.23; α 1.795, β 1.842, γ 1.874, $2V_{\alpha}$ 80°; cleavage (010) perfect, (100) good, (001) and ($\bar{1}01$) distinct. Chemical composition [analysis not given] $(\text{Zn}_{1.73}\text{Fe}_{0.05}\text{Mg}_{0.09}\text{Ca}_{0.10})\text{Cu}_{1.07}\text{As}_{1.90}\text{Si}_{0.10}\text{O}_8$, approximating to $\text{Zn}_2\text{Cu}[\text{AsO}_4]_2$. [A.M. 45-1315] R. A. H.

PHYSICAL PROPERTIES OF MINERALS

ПОВАРЕННŪKH (A. S.) Поваренных (A. C.). Вычисление твердости минералов по моосу на основании кристаллохимических данных [*Calculation of the hardness of minerals on Moh's scale of hardness on the basis of crystal-chemical data*]. Мин. сборник Львов. геол. общ. [Min. Mag. Lvov Geol. Soc.], 1959, 13, 84-106, 3 figs.

Methods of estimating hardness including the micro-hardness and scleritization are reviewed. The author proposes a formula based on crystal-chemical principles in order to calculate the hardness of minerals. The effect of polyvalency is accounted for. N. R.

WELLWIG (L. F.) & HILL (W. E., Jr.). *Variations in interference figures in single crystals of zoned smoky quartz*. Amer. Min., 1960, 45, 1116-1119, 1 fig.

In sections normal to the c axis colourless zones produce a positive uniaxial or biaxial figure, $2V$ small; smoky zones of the same section, with few exceptions show larger $2V$, up to $7\frac{1}{2}$ -8°. In several crystals no difference in $2V$ was perceptible throughout the zones; $2V$ is never larger in a colourless zone. No crystal was found to be uniaxial throughout. Spectrographic analysis indicated Ca, Fe, and Cu equal in colourless and smoky pairs, Mg, Al, and V slightly higher in the smoky member. It is concluded that the zoning must be due to structural change resulting from an orderly substitution of one element for another according to a fixed pattern. A. C. H.

JOHNSON (P. O.). *Dichroic color centers in calcium fluorophosphate (apatite)*. Journ. Appl. Phys., 1961, 32, 127-128, 2 figs.

Optical absorption responsible for the dichroism in the apatite crystals examined occurs only when the electric vector of the transmitted radiation has a component parallel to the optic axis. An examination of the apatite structure has indicated that the absorbing centres are at or between fluoride sites, with the three possibilities being, substituting for F^- , an F^\cdot centre, or a V centre. It is hoped that electron spin resonance may make possible the positive identification of these centres. R. G. Wls.

BOWEN (E. J.). *Luminescence in relation to organic compounds*. CIBA Review, 1960, 12, no. 140, 2-12, 7 figs., 3 pls.

The phenomena of fluorescence, phosphorescence, and chemi-luminescence are briefly discussed. Coloured photographs are reproduced of Spanish fluorite showing a blue fluorescence attributed to rare earths and of chabazite from Val Bregaglia, Switzerland, showing a green fluorescence activated by uranium. R. A. H.

FULLER (D.). *Identification of the diffusion of iron ions in magnetite employing markers*. Acta Metallurgica, 1960, 8, 743-744, 7 figs.

In the oxidation of Armco iron it was found that iron diffuses through magnetite to combine with oxygen on the surface. No evidence was found of the diffusion of oxygen through the magnetite layer. R. G. Wls.

OISHI (Y.) & KINGERY (W. D.). *Self-diffusion of oxygen in single crystal and polycrystalline aluminum oxide*. Journ. Chem. Phys., 1960, 33, 480-486, 6 figs.

Diffusion of oxygen in synthetic corundum was measured by ^{18}O exchange. Above 1650°C diffusion is by means of O-Al vacancies, with an activation energy of 157 Kcal/mol, and at lower temperatures is controlled by impurities and structure. Sintered powder has diffusion coefficients two orders of magnitude larger because of grain boundary diffusion. W. T. H.

CANNON (P.). *The submonolayer adsorption of argon and krypton on molybdenum disulfide; phenomenological comparison with studies on graphite*. Journ. Phys. Chem., 1960, 64, 858-861, 4 figs.

Absorption isotherms on synthetic and natural materials are figured; heats of absorption will be published later. Chemical analyses: Mo, 58.4₁, 59.4₁; S, 38.7₀, 40.3₄; Si, 0.09, 0.06; Pb, <0.01, <0.003; Hg, <0.01; Ag, <0.005, on massive specimens from Kingsgate, New South Wales, and Ontario, respectively. W. T. H.

WADE (W. H.) & HACKERMAN (N.). *Heat of immersion. IV. The alumina-water system—variations with particle size and outgassing temperature.* Journ. Phys. Chem., 1960, **64**, 1196–1199, 2 figs.

Measurements on synthetic corundum and γ - Al_2O_3 are interpreted in terms of a surface covering of 19 OH's/100 \AA^2 .
W. T. H.

DRY (M. E.) & BEEBE (R. A.). *Adsorption studies on bone mineral and synthetic hydroxyapatite.* Journ. Phys. Chem., 1960, **64**, 1300–1304, 5 figs.

Adsorption isotherms and calorimetric heats of adsorption were measured for methanol and water vapours. The high heats measured for the first monolayer indicate high energy of binding by hydrogen bond formation with exposed oxygen atoms of the mineral surface.
W. T. H.

CLARK (S. P., Jr.). *Effect of pressure on the melting points of eight alkali halides.* Journ. Chem. Phys., 1959, **31**, 1526–1531, 3 figs.

Measurements to 225 kilobars were fitted to the Simon equation $p-p_0 = A (T/T_0)^c - 1$, where T_0 is the melting point at pressure p_0 , and A and c are adjustable constants. The theoretical significance of the constants is discussed, but is still in doubt.
W. T. H.

TWOMEY (S.). *Nucleation of ammonium chloride particles from hydrogen chloride and ammonia in air.* Journ. Chem. Phys., 1959, **31**, 1684–1685, 1 fig.

Measurement of nucleation rates at varying partial pressures are interpreted in terms of a crystal free surface energy of 130 erg cm^{-2} .
W. T. H.

ARONSON (S.) & CLAYTON (J. C.). *Thermodynamic properties of nonstoichiometric urania-thoria solid solutions.* Journ. Chem. Phys., 1960, **32**, 749–754, 5 figs.

Measurements of solid solutions with various thorium and oxygen contents were made in an electrochemical cell at 1150–1350°K. Calculated partial molar free energies, entropies, and enthalpies of solution of oxygen in the solid solutions are discussed in terms of interstitial solution of oxygen ions.
W. T. H.

GILMAN (J. J.). *Direct measurements of the surface energies of crystals.* Journ. Appl. Phys., 1960, **31**, 2208–2218, 4 figs.

Surface energies of a number of simple crystals including calcite, fluorite, periclase, and others, were measured directly by cleavage techniques. Measured values for their respective surface energies are reported. Values for the ionic crystals are in good agreement with simple ionic

lattice theory, and for the other crystals seem consistent with their binding energies.
R. G. Wls.

TEUTONICO (L. J.). *On the measurement of C_{13} in rhombohedral crystals.* Journ. Appl. Phys., 1961, **32**, 119.

The author discusses a means by which the elastic constant C_{13} may be determined so that the third principal mode axis in rhombohedral crystals may be established within fifteen degrees. Values are given for elastic constants of some rhombohedral crystals including calcite and sapphire.
R. G. Wls.

MILKEY (ROBERT G.). *Infrared spectra of some tectosilicates.* Amer. Min., 1960, **45**, 990–1007, 13 figs.

The major absorption peaks occur within a narrow spectral range from 9.1 to 10.2 μ ; they are due to the primary bond-stretching vibrations of the O-Si-O linkages. A shift of the major absorption peaks toward longer wavelengths was noted as the aluminium-silicon ratio increases. The spectra of the tectosilicates could be correlated in groups according to similarities in the tetrahedral structure; only a few minerals have distinctive peaks beyond the range of the major absorption. The high intensity of the major absorption peaks reflects the ionic character of the silicon-oxygen bond. In general as little as a few milligrams of the tectosilicate could be detected from its major absorption peak. The spectra are figured for 57 tectosilicates including modifications of silica, K-feldspar, plagioclase feldspars, fibrous zeolites, the heulandite group, the chabazite group, the phillipsite group, miscellaneous zeolites, the sodalite group, the nepheline group, scapolite and other minerals.
A. C. H.

OMORI (KEIICHI). *Infrared absorptions of feldspars.* Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1960, **45**, 179–186, 7 figs., 1 table, (in Japanese).

Infrared absorptions of orthoclase from Naegi, Gifu Prefecture, perthite from Ishikawa, Fukushima Prefecture, moonstone from Korea, albite from Alp Ruscuna, oligoclase-andesines from Nagano Pref., Naka-Iwo-jima and Iwo-jima islands were studied by Perkin & Elmer 21 type double-beam infrared spectrophotometer. Feldspars have a strong broad band at 8.5–11 μ and some medium sharp bands at 13–15 μ , by which high and low types of plagioclases are distinguishable.
M. S. J.

ROACH (CARL H.). *Thermoluminescence and porosity of host rocks at the Eagle Mine, Gilman, Colo.* Progress Paper U.S. Geol. Survey, 1960, **400B**, B107–111, 3 figs.

Thermoluminescence and porosity may be related to distance from ore and to alteration associated with ore. Variation in these properties may be a useful guide to ore.
K. S.

ANGINO (ERNEST E.). *Some effects of pressure on the thermoluminescence of limestone.* Journ. Geophys. Res., 1959, **64**, 1638-1640, 1 fig., 1 table.

Four out of seven limestones exhibited thermoluminescence of the high temperature type after being subjected to a pressure of 7720 bars. The limestones were preheated before pressing to remove natural thermoluminescence. The ratio of pressure-induced to natural thermoluminescence ranged from 0.15 to 1.08. It is suggested that deep burial might produce a large fraction of the natural thermoluminescence in limestones.

F. R. B.

VON HERZEN (R.) & MAXWELL (A. E.). *The measurement of thermal conductivity of deep-sea sediments by a needle-probe method.* Journ. Geophys. Res., 1959, **64**, 1557-1563, 3 figs., 4 tables.

A heating wire and thermistor mounted in a hypodermic needle form the basis of an apparatus that can be used to measure thermal conductivity of sediments in 10 minutes or less with an accuracy of 3-4%. Determinations compare favourably with those made on the same samples by steady state methods.

F. R. B.

BERMAN (R.), FOSTER (E. L.), SCHNEIDMESSER (B.), & TIRMIZI (S. M. A.). *Effects of irradiation on the thermal conductivity of sapphire.* Journ. Appl. Phys., 1960, **31**, 2156-2159, 4 figs.

The thermal conductivity between 2° and 100°K was measured on synthetic sapphire and sintered alumina before and after reactor and gamma ray irradiations. Reactor irradiation appeared to produce two types of thermal resistivity-producing defects, one of which is dominant at low temperatures. The only observed effect of gamma irradiation was an extra thermal resistivity at low temperatures which saturated for quite small doses. The saturation value seemed to depend on the initial perfection of the crystal and was increased by reactor-produced damage.

R. G. Wls.

FORSTAT (H.), TAYLOR (G.), & KING (B. R.). *Low-temperature heat capacity of azurite.* Journ. Chem. Phys., 1959, **31**, 929-931, 3 figs.

The measured heat capacity anomaly at 1.8°K and the associated entropy change, are consistent with the previously observed paramagnetic-antiferromagnetic transition.

W. T. H.

OTSU (HIDEO). *Thermodynamical study on the formation of some iron minerals under the hydrothermal environment.* Bull. Geol. Survey Japan, 1960, **11**, 555-575, 26 figs., 3 tables, (Japanese with English summary).

From the equilibrium constant or oxidation potential of the fundamental reaction which indicates the chemical

reaction between the mineral and its surroundings at the time of formation, the basal condition for the formation of iron minerals, such as hematite, magnetite, pyrite, pyrrhotite, chalybite, and chlorite has been calculated as a function of (1) activities of solutes in the hydrothermal solution, (2) fugacities of coexisting gases, and (3) temperature. From the results of these thermodynamical calculations, approximate, mean environment of the formation of a paragenetic assemblage of minerals is theoretically inferred. As actual examples, the environments—temperature, fugacities, pH, Eh—for the formation of the mineral assemblages magnetite-chalybite-pyrite-pyrrhotite-chlorite, and hematite-magnetite-pyrite-chalybite-chlorite-quartz have been considered.

M. S. J.

TAKENAKA (SHUNZO). *The thermoelectric effect of pyrite from copper deposits in Japan.* Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1958, **42**, 31-38, 3 figs., 2 tables, (Japanese with English summary).

The thermopotential of each of 130 pyrite crystals from 13 copper deposits of various types in Japan was measured by F. G. Smith's method. No definite correlation was found between the values and types of thermopotential of these pyrites and the temperature of formation.

I. S.

SUZUKI (TERUO). *The study of pyrite. (II) Measurements of thermo-electric potential of pyrite from Chichibu mine.* Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1960, **44**, 171-178, 6 figs., (Japanese with English summary).

Thermo-electric potential of pyrite from the Chichibu mine, Japan, was measured on an electrolytically etched section, the results being in good agreement with those obtained on a polished section. It is found that the values of thermo-electric potential vary at different zones within the crystal, and that most of the zones show *p*-type potential, while a few show *n*-type.

M. S. J.

GÖTTE (A.) & RAMDOHR (H.). *Über Änderungen der elektrischen Leitfähigkeit von Mineralien unter Einwirkung von Reaktorbestrahlung.* Neues Jahrb. Min., Abhandl., 1960, **94**, 1101-1124, 12 figs.

The electrical conductivity of semiconductors such as galena and pyrite and of insulators such as fluorite and blende is changed by irradiation in a pile. It is suggested that such changes are related to foreign atoms, derived from radioactive decay of activated components, and to the formation of colour centres.

R. A. H.

MARTINEZ (E.) & ZUCKER (G. L.). *Asbestos ore body minerals studied by zeta-potential measurements.* Journ. Phys. Chem., 1960, **64**, 924-926, 4 figs.

Surface electrical properties of chrysotile and lizardite from Quebec Mine, Thetford, Quebec, were studied by measuring streaming potential in solutions of various composition and pH. A very sharp increase in zeta potential with chrysotile, as pH is decreased from 7 to 3, may be due to removal of OH.

W. T. H.

SENFLE (FRANK E.), THORPE (ARTHUR), & FLANAGAN (FRANCIS J.). *Magnetic susceptibility and thermoluminescence of calcite*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B401-402, 2 tables.

Natural thermoluminescent crystals have enough electron traps to affect the magnetic susceptibility significantly.

K. S.

HARGRAVES (ROBERT B.). *Magnetic anisotropy and remanent magnetism in hemo-ilmenite from ore deposits at Allard Lake, Quebec*. Journ. Geophys. Res., 1959, **64**, 1565-1578, 9 figs., 5 tables.

A strong negative magnetic anomaly is present over the hemo-ilmenite deposits at Allard Lake. The ore consists of sheets of massive ferrian ilmenite with disc-shaped exsolution lamellae of titanohematite oriented parallel to the basal plane of the ilmenite. Two analyses of pure hemo-ilmenite from the Lac Tio mine gave: TiO_2 38.2, 38.10, FeO 28.05, 29.20, Fe_2O_3 31.00, 28.70, MgO 2.55, 2.80, MnO 1.03, 1.02. The magnetic susceptibility of the ore was found to be anisotropic with a plane of maximum

susceptibility parallel to the exsolution lamellae of titanohematite. There is a tendency for remanent magnetism vectors to lie in or near this plane, and almost all samples are reversely polarized. On the assumption that hematite is potentially ferromagnetic in the basal plane only, the RM vectors could represent the resolved component of the magnetizing field which tended to lie in the plane of maximum susceptibility. On this hypothesis it is possible to resolve the broad spread of the RM vectors of samples from one deposit in terms of a single magnetizing field direction.

F. R. B.

HALL (J. M.) & NEALE (R. N.). *Stress effects on thermoremanent magnetization*. Nature, 1960, **188**, 805-806 and 843, 3 figs.

Pressure during acquisition of a thermoremanent magnetism caused rotation and reduction in intensity of the moment. The amount of rotation depends on the pressure, its direction relative to the magnetizing field, and the grain size of the magnetic constituents of the rock. Every specimen studied was found to have a small intrinsic anisotropy which, after unstressed heatings, caused consistently a departure, of up to 4° , between the directions of magnetization and magnetizing field.

M. J. Le B.

DEUTSCH (E. R.) & WATKINS (N. D.). *Direction of the geomagnetic field during the Triassic period in Siberia*. Nature, 1961, **189**, 543-545, 3 figs.

M. J. Le B.

ROCK-FORMING MINERALS AND PETROLOGY

Rock-forming minerals

HERITSCH (HAYMO) & HÖLLER (HELMUT). *Untersuchungen an stengeligem Quarz eines Schriftgranites von Zwiesel, Bayern*. Tschermarks Min. Petr. Mitt., 1960, ser. 3, **7**, 200-203, 1 fig., 2 tables.

Optical and X-ray observations show that quartz rods intergrown with microcline in this graphic granite have a constant orientation and optical character (right or left) over many centimetres. The results are shown graphically in exemplary fashion.

A. P.

SHIMIZU (JIRO) & KUNO (HISASHI). *Notes on rock-forming minerals, (14). Anorthoclase phenocrysts in trachyte from Puu Anahulu, Hawaii Island*. Journ. Geol. Soc. Japan, 1960, **66**, 547-548, 2 tables.

Chemical analysis by H. Haramura of anorthoclase phenocrysts separated from the trachyte of a lava dome on the northern flank of Hualalai volcano in the island of Hawaii shows SiO_2 64.85, Al_2O_3 19.36, Fe_2O_3 0.99, FeO n.d.,

MgO 0.37, CaO 0.56, Na_2O 7.97, K_2O 4.96, $\text{H}_2\text{O} +$ 0.47, $\text{H}_2\text{O} -$ 0.05, TiO_2 tr., = 99.58. The optical properties are α 1.528, β 1.531-1.532, γ 1.533, $2V(-)$ $43-46^\circ$. These values and the results of X-ray analysis agree with those given for members of the high-albite-sanidine series having compositions about $\text{Or}_{28}(\text{Ab-An})_{72}$.

M. S. J.

URUNO (KATSUTOSHI). *Variations in the temperature optical properties of plagioclases in the Tabashine adamellite mass*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1958, **42**, 70-82, 10 figs., 2 tables, (in Japanese with English summary).

The orientations of the optical elasticity axes of albite twins of about 300 plagioclase crystals in 34 thin sections of the Cretaceous Tabashine adamellite stock of the Kitakami mountainland, north-east Japan, were measured on the universal stage. Projection of the twin plane (010) on the optical plane showed wide variations between the high- and low-temperature positions for the composition range of

0-60%An. Different temperature forms apparently co-exist even in a single crystal. The writer considers that such wide variation within one stock and within a single crystal is more likely to have been caused by unstable crystallization conditions, due to convection currents in the magma, than by incorporation of xenocrysts of the different forms, or by the thermal events after the crystals had grown.

I. S.

RIBBE (PAUL H.). *An X-ray and optical investigation of the peristerite plagioclases*. Amer. Min., 1960, **45**, 626-644, 7 figs.

Low-temperature plagioclase feldspars in the peristerite range $An_{5\pm 2}$ to $An_{17\pm 2}$ unmix on a submicroscopic scale to An_{0-6} and An_{20-35} (average An_3 and An_{25}). The unmixing relieves internal stresses created by the substitution of Al for Si in the tetrahedral framework. The optical properties of the peristerite are weighted averages of those of the domains. New optical determinations are given for analysed peristerites; X-ray precession determination of d_{001}^* gives the An content of the two domains in each. Heating at 1000°C causes first disordering of Na and Ca between domains, followed by disordering of Si and Al within domains and later disordering of Si and Al between domains. The blue schiller seen in most peristerites is retained until the last step in disordering (homogenization). Homogenization can be followed by optic angle measurements.

L. G. B.

DIVLJAN (STEVAN). *The results of field and laboratory studies of aventurine plagioclases from some Norwegian pegmatites*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **17**, 94-101.

In plagioclases (predominantly oligoclases) from pegmatites in the Precambrian of SE Norway, the aventurinization is due to a content of 0.1-0.2% Fe_2O_3 . The temperature of formation of the feldspars is ca. 400-450°C according to T. F. W. Barth's method and it is concluded that the aventurinization cannot be due to exsolution of Fe_2O_3 from the feldspar lattice during cooling. Field observations make it likely that the hematite was introduced into the feldspars during regional metasomatism.

H. M.

UTLAND (R. W. R.). *Discussion. The control of anorthite content of plagioclase in metamorphic crystallization*. Amer. Journ. Sci., 1961, **259**, 76-79.

Discussion of paper by de Waard [M.A. **14**-521] relating to convenient metamorphic facies boundaries in the plagioclase composition-intervals near An_5 , An_{20} , An_{32} . A facies boundary at An_{20} is here discounted; the others are accepted with caution.

H. W.

HAYASE (ICHIKAZU). *Radioactivity of feldspars and biotites in the granitic rocks in the Misasa-Kurayoshi region, Tottori Prefecture*. Bull. Geol. Survey Japan, 1959, **10**, 801-807, 10 figs., 2 tables, (Japanese with English summary).

The radioactive source of the granitic rocks of the region has been studied by autoradiography. It is found that radioactive source matter is distributed not only as fine-grained radioactive minerals but also within the main rock-forming minerals. The intensity of radioactivity within the common rock minerals usually decreases in the order—altered plagioclase, fresh sodic plagioclase, and potash feldspar in each individual specimen. The age of the radioactive source of the main rock-forming minerals is estimated to be about the same as of the host granite.

M. S. J.

MITSUDA (TAKESHI). *Pseudomorphs of kaolinite after biotite. (Studies on mechanism of weathering, 1st report)*. Journ. Fac. Sci., Hokkaido Univ., ser. iv, 1960, **10**, 481-494, 6 figs., 3 pls., 2 tables.

X-ray, thermal, and chemical analyses and infrared tests were made of kaolinites pseudomorphous after biotites from a deeply weathered granite. Crystals, with hexagonal prism form, are well-crystallized with the c-axis parallel to that of the parent biotite; d_{001} is 7.17 Å. The Al/Si ratio ranges from 0.89 to 1.07, showing a good agreement with the theoretical value. The interpretation given for the formation of the kaolinite is that the alkalis, alkali-earth, and a part of the Fe and Si in biotite were dissolved out by meteoric water (pH 5-6) over a long period leaving pseudomorphs in kaolinite. An assumption that the Al in biotite was not dissolved out under the condition of pH 5-6 makes it possible to calculate the volume change from biotite crystal to kaolinite pseudomorph, and the calculation showed good agreement with the observed value.

M. S. J.

[SHEVCHENKO (E. V.) Шевченко (Е. В.). Амфиболы криворожской метаморфической толщи [*Amphiboles of the Krivoy Rog metamorphic formation*]. Мин. сборник Львов. геол. общ. [Min. Mag. Lvov Geol. Soc.], 1959, **13**, 296-315, 4 figs.

Amphiboles including edenite (A), hornblende (B), arfvedsonite (C), grunerite (D), cummingtonite (E), and actinolite (F) are described with chemical analyses.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	K ₂ O	H ₂ O	Total
A	49.40	12.9	1.4	2.1	0.01	16.81	13.83	1.05	0.45	2.00	99.96
B	41.10	11.47	4.25	15.8	0.23	9.60	11.35	1.12	0.56	2.80	99.14
C	49.8	2.91	6.20	23.1	0.03	4.25	3.91	4.15	2.09	2.92	99.31
D	48.5	2.27	0.80	42.5	0.08	2.05	1.63	0.48	0.22	1.72	100.28
E	50.60	1.69	1.98	29.30	0.32	11.72	1.10	0.72	0.69	2.63	100.87
F	51.5	4.01	1.95	14.85	0.55	12.90	11.75	0.84	0.18	1.71	100.54

Totals include: TiO₂—A 0.01, B 0.85, C 0.05, D 0.03, E 0.12, F 0.3; and Cr₂O₃ A tr. B 0.01.

Optical and spectrographic data are: edenite, O.A.P. || (010), $c: \gamma$ 18°–20°, α 1.649, γ 1.669, $2V_{\alpha}$ 63°; Mn, Ti, Ni, Cu, Zn, Zr, & Mo are minor elements: hornblende, $c: \gamma$ 16.5°–18.5°, α 1.667, γ 1.688, $2V_{\alpha}$ 67°–71°, α yellowish green, β pale yellow, γ grey green; Mn, Ti, Ni, Co, Cu, Cr are minor elements: arfvedsonite, $c: \gamma$ 21°, α 1.686, γ 1.697, $2V_{\alpha}$ 24°, α greenish-brown or greenish yellow, β dark green to blue-green, γ dark blue; Mo, Zr, Cr, Ti, Cu, Mn are minor elements: grunerite, $c: \gamma$ 10°–11°, α 1.685, γ 1.729, $2V_{\alpha}$ 86°, no pleochroism in thin section; Mn, Cu, Zn are minor elements, other traces: cummingtonite, $c: \gamma$ 9°–21°, α 1.660, γ 1.690–1.705, $2V_{\alpha}$ 88°, no pleochroism in thin section; Mn, Ti, Ni, Co, Cu, & Mo are minor elements, actinolite, $c: \gamma$ 18°–19.5°, α 1.623, γ 1.647, $2V_{\alpha}$ 78°, pleochroism α not coloured β grey-yellowish, γ pale grey-green.

N. R.

HERITSCH (HAYMO), BERTOLDI (GERHARD), & WALITZI (EVA-MARIA). *Strukturuntersuchung an einer basaltischen Hornblende vom Kuruzzenkogel südlich Fehring, Steiermark* [Styria]. *Tschermaks Min. Petr. Mitt.*, 1960, ser. 3, **7**, 210–217, 1 fig., 7 tables.

This basaltic hornblende has been reanalyzed and optical properties and cell dimensions determined; analyst G. Bertoldi, SiO_2 39.85, Al_2O_3 14.74, TiO_2 4.40, Fe_2O_3 5.17, FeO 5.38, MgO 13.16, CaO 11.54, Na_2O 2.23, K_2O 1.86, $\text{H}_2\text{O}+1.86$, = 100.19; α 1.664 nearly colorless, β 1.672 reddish brown, γ 1.681 greenish yellow-brown, $c: \gamma$ 18°, $2V_{\alpha}$ (obs.) 82°; space group $I2/m$, a 9.97 ± 0.07 Å, b 18.22 ± 0.2 , c 5.365 ± 0.025 , β $105^\circ 30' \pm 10'$, sp.gr. (obs.) 3.21, (calc.) 3.13. By successive electron density projections onto (001) x and y parameters are refined while z parameters are obtained from space considerations. The (0½0) position is occupied by ($\text{Na}_{0.46}\text{K}_{0.35}$) with 2 oxygens at 3.4_2 Å, 4 at 3.0_5 , 4 at 3.1_4 and 2 at 2.7_8 [see following abstracts].

A. P.

HERITSCH (HAYMO) & KAHLER (ERENTRAUD). *Strukturuntersuchung an zwei Kluftkarinthinen. Ein Beitrag zur Karinthinfrage*. *Tschermaks Min. Petr. Mitt.*, 1960, ser. 3, **7**, 218–234, 6 figs., 11 tables.

Chemical analyses, optical properties, cell contents, and density are reported for two amphiboles, variety carinthine, occurring in rock clefts at the Saualpe and at Kupplerbrunn, Carinthia. The structure previously found for carinthine is confirmed and refined as to x and y parameters by difference syntheses. Identical parameters are obtained for the two carinthines. The (0½0) positions, regarded as 10-coordinated, 2 oxygens at 3.45, 4 at 2.98, 4 at 3.10 and 2 at 2.71 Å, are occupied by ($\text{Na}_{0.33}\text{K}_{0.17}$) and ($\text{Na}_{0.33}\text{K}_{0.08}$) respectively [see preceding and following abstracts].

A. P.

HERITSCH (HAYMO) & RIECHERT (LUDWIG). *Strukturuntersuchung an einer basaltischen Hornblende von Černošín, ČSR*. *Tschermaks Min. Petr. Mitt.*, 1960, ser. 3, **7**, 235–245, 1 fig., 6 tables.

A new chemical analysis of this hornblende by L. Riechert gave SiO_2 39.24, Al_2O_3 14.14, TiO_2 4.28, Fe_2O_3 10.24, FeO 0.26, MnO 0.08, MgO 13.68, CaO 12.55, Na_2O

1.88, K_2O 1.68, $\text{H}_2\text{O}+2.41$, = 100.44%. Optical properties are: α 1.675 colorless to pale gray, β 1.703 yellowish brown, γ 1.724 dark brown to yellow-brown, $c: \gamma$ 1–3°, $2V$ (obs.) $78^\circ 40'$; space group $I2/m$, a 9.93 ± 0.02 , b 17.98 ± 0.02 , c 5.33 ± 0.03 Å, β $104^\circ 59' \pm 10'$; sp.gr. (obs.) 3.24, (calc.) 3.19. The x and y parameters of the atoms were refined by difference syntheses. They are very close to those found by Heritsch et. al. for basaltic hornblende from Kuruzzenkogel. The 10-coordinated (0½0) position is occupied by ($\text{Na}_{0.54}\text{K}_{0.32}$). In a table the peaks on the (001) electron density projections of the two basaltic hornblendes and two carinthines reported in this and the two preceding abstracts and of two amphiboles studied earlier [Heritsch, Paulitsch & Walitzi, *Tschermaks Min. Petr. Mitt.*, 1957, ser. 3, **4**, 215–235] are compared with expectation from chemical composition to check the distribution of cations shown in the structural formulas. [See the two preceding abstracts]

A. P.

BANNO (SHOHEI). *Optic axial dispersion of glaucophanic amphiboles*. *Journ. Geol. Soc. Japan*, 1960, **66**, 357–358, 2 figs.

Because of some confusion hitherto in descriptions of the optical axial dispersion of glaucophanitic amphiboles, the writer has revised the data and presents it graphically.

M. S. J.

IWASAKI (MASAO). *Colourless glaucophane and associated minerals in quartzose schists from eastern Shikoku, Japan*. *Journ. Geol. Soc. Japan*, 1960, **66**, 566–574, 1 fig., 8 tables.

The piemontite quartz schists which are intercalated in alkali-amphibole schists in eastern Shikoku, Japan, usually contain colourless amphiboles. Two chemical analyses, by H. Haramura, and the optical data of the mineral are as follows:

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O
A	56.89	<0.05	7.98	7.43	0.33	0.44	15.53	0.86	6.51	<0.10
B	55.56	0.13	6.71	9.16	5.53	0.63	12.35	2.15	5.78	0.20
	$\text{H}_2\text{O}-$	$\text{H}_2\text{O}+$	Total	α	β	γ	$c: \gamma$	$2V(-)$		
A	0.00	3.62	99.74	1.621	1.635	1.637	17°	<20°		
B	0.00	1.93	100.13	1.631	1.646	1.648	21°	33–35°		

A, colourless glaucophane from garnet-muscovite-piemontite-quartz schist of Bizan; B, almost colourless glaucophane from aegirine-garnet-muscovite-piemontite-quartz schist of Kotu. Chemical analyses and optical data for associated muscovite, garnet, and aegirine are also given. The mineral paragenesis of the host rock is considered to be stable under a reducing environment.

M. S. J.

SEKI (YOTARO). *Alkali-amphiboles in the eastern part of the Kanto mountains*. *Journ. Japanese Assoc. Min. Petr. & Econ. Geol.*, 1958, **42**, 128–135, 4 figs., 1 table (Japanese with English summary).

Mode of occurrence, optical properties, and chemical analyses of alkali-amphiboles in the Sambagawa metamorphic rocks in the eastern part of the Kanto Mountains, Japan are described in detail. Optical properties of magnesioriebeckite in magnesioriebeckite-quartz-chlorite-epidote-albite schist from Yorii-machi, Saitama Prefecture, are: α 1.661, β 1.667, γ 1.670, $2V(-)$ 35–47°, $\beta : c$ 24°, $b \parallel \gamma$, $r < v$, pleochroism α pale yellow, β purple, γ blue. Its chemical analysis, by the author, is SiO_2 53.09, TiO_2 0.39, Al_2O_3 3.42, Fe_2O_3 14.41, FeO 8.15, MnO 0.12, MgO 8.14, CaO 2.12, Na_2O 6.01, K_2O 0.21, $\text{H}_2\text{O} +$ 3.28, $\text{H}_2\text{O} -$ 0.61, = 99.95. [M.A. 14–145]. Optical properties of glaucophane in glaucophane-quartz-chlorite-epidote-albite schist from Kurohara are: α 1.637, β 1.640, γ 1.650, $2V(-)$ 22°, $r < v$, $\beta : c$ 11°, $\beta \parallel b$, pleochroism α pale yellowish purple, β pale purple, γ pale blue. Its chemical analysis by the author is: SiO_2 52.86, TiO_2 0.24, Al_2O_3 11.29, Fe_2O_3 5.61, FeO 7.77, InO 1.78, MgO 9.96, CaO 2.42, Na_2O 6.50, K_2O tr., $\text{H}_2\text{O} +$ 0.00, $\text{H}_2\text{O} -$ 0.08, = 100.51. [M.A. 14–428, 506] I. S.

SAITO (HAJIME) & OGASAWARA (KENICHI). *Synthesis of various types of fluo-amphibole by isomorphic substitution*. Journ. Chem. Soc. Japan, Industr. Chem. Sect., 1959, **62**, 976–978, 7 tables, 1 fig., (in Japanese).

Syntheses of various types of fluo-amphibole such as tremolite, richterite, arfvedsonite, edenite, and riebeckite have been accomplished from mixtures of Na_2CO_3 , CaCO_3 , MgO , Fe_2O_3 , Al_2O_3 , MgF_2 , and SiO_2 . The mixtures were made in accordance with the chemical compositions of the minerals, melted in crucibles, held for 30 minutes at 1350°C, and then cooled down to 1000°C with a cooling-rate of 100°/hr. Identification was made by microscopic and X-ray methods. The order of crystallinity of the products was arfvedsonite > riebeckite, richterite > tremolite, edenite. An oxidizing atmosphere was needed for the crystallization of arfvedsonite, because of the reduction of Fe^{3+} . The following three methods were tried, the method (c) being found the best: (a) oxygen gas was sent into the furnace; (b) Fe^{3+} was replaced by Al^{3+} ; (c) Na_2NO_3 , an oxidizing agent, was substituted for part of Na_2CO_3 . M. S. J.

LEWIS (J. F.). *The occurrence of orthopyroxene with low optic axial angle*. Amer. Min., 1960, **45**, 1125–1126.

Orthopyroxene with $2V_\alpha$ as low as 36° was found in the acidic rocks of the oxidized core of a breached dome of the Kurohara volcano, North Island, New Zealand. Cell dimensions and optical properties are given for orthopyroxenes from unoxidized and oxidized rocks. The author thinks it probable that the unusual optical properties are due to oxidation and heating rather than to extreme primary composition. A. C. H.

IWASAKI (MASAO). *Clinopyroxene intermediate between jadeite and aegirine from Suberi-dani, Tokushima Prefecture, Japan*. Journ. Geol. Soc. Japan, 1960, **66**, 334–340, 3 figs., 4 tables.

A clinopyroxene intermediate in composition between jadeite and aegirine was found in clinopyroxene-lawsonite schist from Suberi-dani. Chemical analysis by H. Haramura gave SiO_2 52.41, Al_2O_3 9.47, TiO_2 1.56, Fe_2O_3 15.54, FeO 1.43, MnO 0.12, MgO 2.96, CaO 5.06, Na_2O 9.97, K_2O 0.10, $\text{H}_2\text{O} +$ 1.10, $\text{H}_2\text{O} -$ 0.08, P_2O_5 0.06, = 99.86, corresponding to the molecular proportions aegirine 43, jadeite 36, diopside 17, hedenbergite 4. Provisional cell dimensions are a 9.56, b 8.77, c 5.24 Å, β 72° 13'; space group $C2/c$ (C_{2h}^6). The optical properties are α , pale green, 1.726, β , yellow, γ , pale brown, 1.750, $\gamma - \alpha$ 0.024, all ± 0.003 , $\beta \parallel b$, O.A.P. \parallel (010), $\alpha : c$ 5°, elongation —ive, $2V_\alpha$ 74°–80°, dispersion strong. The optical properties of the associated amphibole and lawsonite are given. M. S. J.

BARTHOLOMÉ (P.). *L'interprétation pétrogénétique des associations d'olivine et d'orthopyroxène*. Ann. (Bull.) Soc. Géol. Belgique, 1959–1960, **83**, 319–344, 5 figs.

Olivines and orthopyroxenes being ideally solutions of forsterite + fayalite and of enstatite + orthoferrosilite respectively, the equilibrium conditions for the reaction: forsterite + 2 orthoferrosilite \rightleftharpoons fayalite + 2 enstatite can be simply written $\frac{\text{Fa (En)}}{\text{Fo (Of)}} = kT$, where Fa, Fo, En, Of are the components in moles; kT is calculated from experimental and other data. Equilibrium diagrams are given. The diagram by Bowen and the isothermal sections by Schairer [M.A. 6–352] are criticized for they demand great deviation from ideality. The value of k may serve for geological thermometry. J. M.

JACKSON (EVERETT D.). *X-ray determinative curve for natural olivine of composition Fo_{80-90}* . Prof. Paper U.S. Geol. Survey, 1960, **400B**, B432–434, 1 fig., 1 table.

A curve more precise than curves published hitherto [M.A. 14–137, 146, 351] is based on values for 5 specimens from the peridotite member of the Stillwater complex [M.A. 7–185, 15–58, 59]. The equation for the linear graph is $42\theta \{0.62_{\text{olivine}} - 220_{\text{Lif}}\} = 4.4587 - 0.017855\text{Fo}$ for Cu radiation with Ni filter. Confidence intervals of 95% are $\pm 0.006^\circ 2\theta$ at 85 mol % Fo and $\pm 0.0075^\circ 2\theta$ at 80 mol % Fo. Measurements of the 062 peak are inherently more precise than of the 130, but the former is less intense and is more subject to interference. K. S.

KUNO (HISASHI). *Notes on rock-forming minerals. (16) Titaniferous pyroxene, spinel, and magnetite in hornfels from Sisaka-zima Islands, Japan*. Journ. Geol. Soc. Japan, 1960, **66**, 616–617, 3 tables.

Clinopyroxene rich in Ti and Al was separated from hornfels nodules in thin lenses of crystalline limestone, exposed in Myozin-zima, one of the islands of the Sisakazima Group, in the Setouti region, Ehime Prefecture, Japan. The other constituents of the hornfels are dark green spinel, magnetite, amphibole, apatite, quartz, chlorite, and calcite. Chemical analysis of the clinopyroxene by H. Haramura gave: SiO_2 45.50, Al_2O_3 6.89, Fe_2O_3 3.24, FeO 3.88, MgO 11.81, CaO 25.95, Na_2O 0.12, K_2O 0.04, $\text{H}_2\text{O} +$ 0.58, $\text{H}_2\text{O} -$ 0.11, TiO_2 2.47, P_2O_5 n.d., MnO 0.08, Cr_2O_3 n.d., = 100.67; optical properties are: α 1.685–(1.718), β 1.692–1.725, γ (1.705)–1.738, $\gamma - \alpha$ 0.020, $2V_\gamma$ 27°–44°, dispersion strong $r > v$, $\gamma : c$ 43°; the colour is purplish brown without pleochroism. Chemical analyses of the dark green spinel by H. Haramura and of magnetite by Katsura, both containing a little amount of pyroxene as impurity, are also presented.

M. S. J.

BOLFA (J.). *Contribution à l'étude des éléments ferromagnétique de coulées historiques des laves de l'Etna (Sicile)*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1049–1059, 3 figs.

The opaque minerals in historic lava flows of Mt. Etna, particularly the homogeneous titanomagnetites, have been studied optically and thermomagnetically. The chemical composition, deduced from the magnetic measurements, is practically constant for all samples.

R. A. H.

[OMEL'YANENKO (B. I.) & SIROTININA (N. A.)] Омеляненко (Б. И.) и Сиротинина (Н. А.). Акцессорные минералы в щелочных породах верховьев р. Ходжа-Ачкан [*Accessory minerals in alkaline rocks in the upper reaches of the river Khodzha-Achkan*]. Мат. геол. руд. мест., петр., минер., геох., Акад. Наук СССР [Mat. Geol. Ore-deposits, Petr., Min., Geochem., Acad. Sci. U.S.S.R.], 1959, pp. 414–422, 4 figs.

Minerals described are: zircon, sphene, melanite, fluorite, pyrochlore, apatite, thorite, astrophyllite, parisite, and monazite.

S. I. T.

OWENS (JAMES P.) & MINARD (JAMES P.). *Some characteristics of glauconite from the coastal plain formations of New Jersey*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B430–432.

Glauconites with low interlayer ion summation, medium to fine grain size and with a high proportion of 'accordion' forms [elongate grains which appear to be stacks of plates] are thought to represent primary types. Reworked glauconites include marine and fluvial detrital types; the former show high interlayer ion summations, rounded shape, and coarse grain size, the latter have a high Fe^{III} to Fe^{II} ratio and are considered to have been subaerially altered.

K. S.

Petrology : general

SAHA (AJIT KUMAR). *On the precision of modal analyses of rocks*. Quart. Journ. Geol. Min. & Met. Soc. India, 1959, **31**, 1–6.

Measuring modal analyses of rocks by Dollar's integrating stage and by the point-counter, the author finds that there are no significant variations. From many measurements he concludes that for accurate modal composition of even an apparently homogenous rock, 3 or 4 thin sections, representative of different parts of the specimen, should be analysed.

A. P. S.

FRIEDMAN (GERALD M.). *Chemical analyses of rocks with the petrographic microscope*. Amer. Min., 1960, **45**, 69–78.

From quantitative modal mineralogical analysis of thin sections it was possible to calculate the chemical composition of granite (G-1); the result agreed closely with the chemical analysis. Good agreement between chemical analysis and composition computed from petrographic measurements was obtained also for a norite.

A. C. H.

HARPUR (J. R.). *Complete analyses of rocks carried out in 1957*. Rec. Geol. Survey Tanganyika, 1959, **7**, 96–104.

Seventy-two complete rock analyses, by W. H. Herdsman are recorded without petrographic descriptions. Analysed rocks include 7 from the Upangwa meta-anorthosite complex, meta-anorthosite from Masailand, 4 Precambrian metadolerites, 7 Precambrian metamorphosed basic and ultrabasic igneous rocks, 9 Precambrian metamorphic rocks, 5 Precambrian granitic rocks, 8 Bukoban dolerites, 2 Bukoban lavas, 6 Bukoban gabbroic rocks, 1 limestone, 1 Archaean lamprophyre, 7 dyke rocks from carbonatite complexes, 4 Neogene pyroclastic rocks, 3 Neogene trachytes, 3 phonolites, 3 Neogene nephelinites, and a Neogene lava from Ngorongoro.

D. McK.

WRIGHT (A. E.). *Complete analyses of rocks carried out in 1958*. Rec. Geol. Survey Tanganyika, 1960, **8**, 106–112.

Thirty-eight complete rock analyses, by W. H. Herdsman are recorded without petrographic descriptions. Analysed rocks include 10 granulites and charnockites from Uluguru and Songea, a metasomatic albitite, 3 meta-anorthosite rocks, 4 from the Kapalagulu norite complex, 6 Bukoban dolerites, 5 from the Nkenza gabbro (Bukoban), a Bukoban greywacke, 2 kimberlitic dykes, and 2 Neogene olivine basalts from Rungwe.

D. McK.

THORNTON (C. P.) & TUTTLE (O. F.). *Chemistry of igneous rocks. I. Differentiation index*. Amer. Journ. Sci., 1960, **258**, 664–684.

The differentiation index of a rock is designed to express how far crystallization-differentiation has progressed toward Bowen's 'petrogenic residua system', which is the common residual of a liquid residue contained in the system (normative) $\text{O}_2\text{-NaAlSiO}_4\text{-KAlSiO}_4$ from a theoretical, or extrapolated starting point of magma containing normative mafic constituents. Thus the index is the sum of percentages of normative quartz, orthoclase, albite, nepheline, leucite, and kalsilite. This index is independent of alkalinity of the rock; it is also not a mere measure of normative quartz and silica saturation, but it does vary with these and with the basicity of the rock. The 'differentiation index' is used in a series of variation diagrams showing frequency distributions for various constituents reported in 5000 analyses from Washington's tables. H. W.

YAMAZAKI (YOSHIO). *On some mutual relations among the mineral constituents of plutonic rock series.* Journ. Fac. Sci., Hokkaido Univ., 1955, ser. iv, **9**, 43-54, 13 figs.

This paper sets forth the advantages of discussing and picturing the mineralogical divisions of plutonic rocks in terms of three chief components, namely, mafic minerals, plagioclase and quartz plus potash-feldspar, especially in dealing with migmatites. A. P.

YAMAGUCHI (HIDEBUMI). *Temperature of granite magma of Kitashirakawa-granite, Kyoto, Japan, as estimated from a heat conduction theory of formation of wollastonite.* Mem. Coll. Sci., Univ. Kyoto, ser. B, 1956, **23**, 305-323, 8 figs., 4 tables.

Using assumptions as to the shape of the granite mass, the distance to the locus of formation of wollastonite in metamorphosed limestone, the mechanism of formation of the wollastonite, and disregarding convection and certain other factors, the temperature of the magma is estimated to have been in the range 1100° to 1800°C for an intrusive level of several thousand metres below surface. A. P.

YMERHORN (L. J. G.). *Telescoping of mineral facies in granites.* Bull. Comm. géol. Finlande, 1960, **188**, 121-132.

In rocks formed at high temperatures but recrystallized at lower temperatures a low-temperature mineral assemblage may be found still showing a high-temperature fabric. Mainly on this basis it is concluded that in granites all albite is secondary. V. M.

MACDONALD (GORDON A.). *Dissimilarity of continental and oceanic rock types.* Journ. Petr., 1960, **1**, 172-177, 1 table.

The term 'andesite', when applied equally to rocks of

oceanic (typically Hawaiian) and continental environments, is shown to be unsatisfactory. The chemical, modal, and environmental differences are demonstrated, and alternative names (neither of which is new to the literature) are proposed for the 'andesites' of oceanic regions. The oligoclase-bearing rocks are to be called mugearites and the andesine-bearing rocks hawaiites, a complete gradation existing between the composition of these and the more basic alkali olivine basalt. G. M. B.

Petrography : regional

KNORRING (O. VON). *Some geochemical aspects of a columbite-bearing soda granite from south-east Uganda.* Nature, 1960, **188**, 204-206.

The Lunyo granite is a foliated rock with zinnwaldite. Microcline porphyroblasts contain inclusions of albite. Accessories include columbite, cassiterite, and thortugummit which are also found in associated pegmatites, aplites, and greisens. This granite occurs in an area of leptites, amphibolites, granodiorites, other granites, and late doleritic dykes. Its formation by metasomatic granitization of soda-rich volcanics of Butenge type is envisaged. 14 chemical analyses of rocks of the region include: A, Lunyo granite; B, meta-rhyolite; C, Butenge leptite; and D, dolerite.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO
A	73.67	tr.	15.24	0.35	0.36	0.01	0.02	0.07
B	84.24	0.17	10.16	0.58	0.13	tr.	0.15	tr.
C	68.36	0.55	15.59	0.64	2.87	0.06	1.33	2.46
D	50.73	1.24	14.09	6.55	6.61	0.20	6.05	10.51

	Na ₂ O	K ₂ O	H ₂ O+	H ₂ O-	P ₂ O ₅	Li ₂ O	Total
A	7.04	3.20	0.07	0.10	tr.	0.13	100.26
B	0.29	3.12	1.20	0.08	0.08	n.d.	100.15
C	6.00	0.75	0.98	0.05	0.13	n.d.	99.77
D	2.48	0.42	1.36	0.08	0.14	n.d.	100.46

Spectrographic analyses show very high values of Li, Rb, Zr, and Nb in the varieties of the Lunyo granite.

M. L. Le B.

GIRAUDON (ROBERT). *Les roches ultrabasiques de la région de Tamatave [Madagascar]. Mode de gisement. Origine et minéralisation.* Bull. Soc. géol. France, 1959, sér. 7, **1**, 608-610, 1 table.

The Ambodiriana series, recently named to signify the series of migmatites, mica schists, and 'amphibolopyroxenites' which outcrop to the north of Tamatave, is cut by ultrabasic intrusions certain of which are mineralized in chromite. These ultrabasic rocks have suffered after emplacement a moderately intense metamorphism. The chrome ore occurs as lenses the strike and dip of which conform with those of the crystalline schists. The content of chromite varies between 60 and 86% according to the deposit, but the ratio Cr:Fe, between 1 and 2 has too low a value for the ore to be of use. Two analyses of the raw ore, eight of purified ore are given. E. J. & A. S.

BATTISTINI (RENÉ). *La structure du massif volcanique de l'Androy (Madagascar)*. Bull. Soc. géol. France, 1959, sér. 7, **1**, 187-191, 2 figs.

Several successive phases of emission alternately acid and basic (rhyolites and basalts) are distinguished. The volcanic complex has the general form of a saucer.

E. J. & A. S.

BROWN (P. E.). *Quarter degree sheet 70 SW., Mbeya*. Rec. Geol. Survey Tanganyika, 1959, **7**, 5-7.

The Precambrian igneous and metamorphic rocks of the Lupa goldfield become intensely sheared towards the Mbeya Range. A ten-mile long intrusion of carbonatite associated with widespread feldspathization and silicification, a plexus of carbonate veins, and an intrusive tuff are emplaced in mylonites along a rift fault in the south-west of the Mbeya Range. Feldspathic breccia plugs and feldspar dykes occur at Mbulu and Musensi. Part of the area is covered by ash, trachyte, or basalt flows of the Rungwe Neogene volcanic province.

D. McK.

PICKERING (R.). *The Serengeti plain: quarter degree sheets 12 SW. and 11 SE.* Rec. Geol. Survey Tanganyika, 1959, **7**, 11-13.

A Precambrian terrain of quartzites, metacalcareous rocks, quartzo-feldspathic gneiss, interbanded quartzite, and ironstone, and granites, poorly exposed through a cover of Pleistocene calcareous tuff, is given preliminary description. The tuff is composed of quartz, feldspar, and ferromagnesian minerals in a calcite groundmass.

D. McK.

HALLIGAN (R.). *South Kigoma and north-west Mpanda districts: quarter degree sheets 35 SE. and NE. and 36 SW.* Rec. Geol. Survey Tanganyika, 1959, **7**, 14-20.

Amphibolites, pyroxenites, acid gneisses, and granulites of the Ubendian system occur in this part of western Tanganyika. The Ubendian is intruded by the Kapalagulu norite lopolith and by several granophyric quartz-dolerites, an analysis of one of which is given. The Uha (amygdaloidal) lavas of the overlying Bukoban system are altered basalts.

D. McK.

HARPUM (J. R.). *The Upper Mbarali River area, Ubena: quarter degree sheet 79 NW., Kipengere*. Rec. Geol. Survey Tanganyika, 1959, **7**, 21-25.

The Ubendian system is here represented by plagioclase-amphibolites, a migmatized meta-anorthositic complex, the Mbarali migmatites, and the Ubena granites (synorogenic granites and granodiorites). The overlying slates of the Ukinga series and phyllitic shales and sandstones of the Buanji series as well as the Ubendian are intruded by a swarm of Bukoban dolerites. Chemical

analyses are given for a plagioclase-amphibolite, a granodiorite, a quartz-diorite, and two dolerites.

D. McK.

SAMPSON (D. N.). *The Uluguru Mountains and their environs: quarter degree sheets 64 NE. and NW. and 54 SE.* Rec. Geol. Survey Tanganyika, 1959, **7**, 26-28.

A preliminary report on further work in this Precambrian (Usagaran) area. [M.A. **14**-307]

D. McK.

WHITTINGHAM (J. K.). *A note on the Ndembera series*. Rec. Geol. Survey Tanganyika, 1959, **7**, 35-37.

The microcrystalline rocks of the Ndembera series in the Precambrian of central Tanganyika may be rhyolites or mylonites; the evidence for a cataclastic origin is suggestive.

D. McK.

JAMES (T. C.). *Carbonatite investigation—progress report*. Rec. Geol. Survey Tanganyika, 1959, **7**, 65.

D. McK.

HARPUM (J. R.). *A camptonite from Lemagrut*. Rec. Geol. Survey Tanganyika, 1959, **7**, 93.

The petrography of a porphyritic augite camptonite from the Lemagrut crater (Neogene) in northern Tanganyika is given.

D. McK.

HORNE (R. G.). *Quarter degree sheet 70 SE., Irambo*. Rec. Geol. Survey Tanganyika, 1960, **8**, 15-16.

This Precambrian terrain in south-western Tanganyika is dominantly Ubendian migmatitic granite-gneiss, with which are associated banded ferruginous kyanite quartzites, a gabbro-peridotite-herzolite-troctolite complex in the Nsamy Hills, and a dioritic complex on the Usungu Escarpment. Later emplacement of a granodiorite body, auriferous quartz reefs, and Bukoban minor intrusions are mentioned in this preliminary note.

D. McK.

PICKERING (R.). *The Itonjo Hills: quarter degree sheets 11 SE.* Rec. Geol. Survey Tanganyika, 1960, **8**, 6-8.

Amphibolite, transfused mylonite, and banded quartzite and ironstone with shale are intruded by granite and overlain by Bukoban quartzite and shale in this area to the west of the Serengeti Plain. The Neogene calcareous tuff of the Serengeti is represented by a poorly exposed limestone facies in the Itonjo Hills.

D. McK.

QUENNELL (A. M.), MCKINLAY (A. C. M.), & AITKEN (W. G.). *Summary of the geology of Tanganyika. Part I. Introduction and Stratigraphy*. Mem. Geol. Survey Tanganyika, 1959, **1**, 264 pp., 1 overlay map (1:2,000,000) of type localities.

——— *Part II. Geological map of Tanganyika*. 1960, 6 pp., 1 coloured folded map (1:2,000,000).

The pre-Karoo rocks of Tanganyika are reclassified. The Dodoman System in west-central Tanganyika has been regionally metamorphosed and involved in extensive migmatization; it is older than 2530 m.y. The Nyanzian System and the younger, but structurally associated, Kavirondian System occur as relics among the granites to the south and east of Lake Victoria. The Usagaran and Ubendian Systems form the eastern and western branches of the Mozambique orogenic belt; they have been regionally metamorphosed, locally migmatized, and intruded by granitic and by anorthositic complexes. The Usagaran is older than 600 m.y. and the Ubendian older than 980 m.y.; they are probably polycyclic units of broadly similar age. The Karagwe-Ankolean System of low-grade regionally metamorphosed sediments in western Tanganyika is younger than the Kavirondian and Ubendian Systems. The sediments and plateau basalts of the Bukoban System occur in the west; they are in general unmetamorphosed and may be Eocambrian in part. Correlation with other parts of Africa is discussed. All stratigraphical terms in the literature are listed.

D. McK.

MARKIN (D. A.). *The Rungwe volcanics at the northern end of Lake Nyasa*. Mem. Geol. Survey Tanganyika, 1960, **11**, 172 pp., 32 pls. [incl. diagrams], 3 coloured maps, 1 coloured pl. of sections, 63 tables. Price 25s.

The Rungwe volcanics, of Neogene age, cover about 100 sq. miles. They include an older and a younger series of basaltic and trachytic-phonolitic lavas and tuffs; the younger series contains trachyandesites and melanephelinites. The major central volcanoes Rungwe, Kijejo, and Mkujuu and the caldera of Ngozi belong to the younger series. The province is petrographically alkali-basaltic and almost all the rocks are undersaturated with a tendency to high CaO content; an unusually large volume of salic differentiates and the intensely explosive character of the eruptions are distinctive. 19 new chemical analyses (1 sanite, 1 tephrite, 4 basalts, 2 melanephelinites, 1 campite, 1 phonolite, 5 phonolitic trachytes, 2 trachyandesites, 1 quartz-trachyte, 1 syenite) are given, and the petrography is summarized in 29 tables. The petrochemistry is compared with that of basaltic provinces elsewhere; in the discussion of petrogenesis it is suggested that contamination by carbonatites of earlier age would explain the undersaturation of the basaltic magma, the silic differentiation, and the explosive character of the activity.

J. Ph.

AWSON (J. B.). *Basutoland kimberlites*. Nature, 1961, **189**, 475.

A preliminary account of a new kimberlite province is given. The kimberlites contain inclusions of eclogite,

granulite, peridotite, ilmenite, and Karroo country rocks. Trace elements are of ultrabasic and alkaline late differentiate affinities.

M. J. Le B.

PORTUGAL (M. R.) & FERREIRA (VASCONCELOS). *Rochas da bacia do Cassai (Angola)*. Mem. & Not., Publ. Mus. Lab. Min. Geol., Univ. Coimbra, 1958, **45**, 22-39, 1 fig., 8 pls., (English and French summaries).

Petrographical descriptions of rocks collected from the Cassai basin, approx. 7°-11°S. Lat., 20°-22°E. Long., are given for granitic rocks, pigeonite dolerites, siliceous sediments, biotite-hornblende gneiss, and amphibolite.

J. Ph.

DARNLEY (A. G.). *Petrology of some Rhodesian Copperbelt orebodies and associated rocks*. Trans. Inst. Mining & Metall., 1960, **69**, 137-173, 10 figs. (*Discussion and reply*, *ibid.*, 371-398, 540-569, 699-719).

Rhodesian Copperbelt orebodies are considered to be of hydrothermal origin, derived from an unexposed magmatic source. Conclusions are based on geochemical, mineralogical, textural, and regional considerations. The mineralization was localized in carbonaceous quartzites; biotite and chlorite are absent where sulphides are present, and in the higher grades of mineralization there is extensive replacement of feldspar by sericitic aggregate. A low Na content is characteristic of all rock-types containing significant Cu. The region has been subjected to widespread K and B metasomatism; Na and CO₂ metasomatism are more localized and are probably of later date and related to scapolitized basic intrusions. An unusual sill, composed principally of albite and biotite with associated minor high-cobalt pyrite, chalcopyrite, tourmaline, and allanite, is considered to be important evidence of magmatic origin of the ores. The magmatic solutions were probably introduced penecontemporaneously with the deposition of Lower Roan sediments, the main phase of sulphide mineralization occurring towards the end of the period when rock temperatures were high but before metamorphic recrystallization had advanced sufficiently to eliminate differences in permeability due to the original lithology.

[M.A. 14-109, 110]

R. A. H.

RAULAIS (MAURICE). *Esquisse géologique sur le massif cristallin de l'Aïr (Niger)*. Bull. Soc. géol. France, 1959, sér. 7, **1**, 207-223, 3 figs, 3 pls.

The Precambrian crystalline basement of l'Aïr is composed of metamorphic series, folded and granitized, of the catazone and the epizone corresponding respectively to the Soggarian and the Pharusian of Ahaggar. The Soggarian is essentially an aluminous, biotitic series with intercalations of mica schist, quartzite, cipolin, amphibolite, epidote,

gneiss with orthorhombic and monoclinic pyroxenes (charnockite). The Pharusan is formed mainly of conglomerates with feldspathic schist cement and with pebbles of various kind; the author considers that they are tillites. These series contain basic (mainly basaltic) and granitic intrusive or effusive rocks. The older granites are biotite- and muscovite-biotite-granites. The younger are highly alkaline, with riebeckite and aegirine; one facies of the younger is a biotite-granite with which a cassiterite, wolfram, and columbite mineralization is associated. Hyperalkaline and alkaline rhyolites are later than the younger granites, and alkaline trachytes are more recent than the rhyolites.

E. J. & A. S.

GÜNTHER (A. W.) & RICHARDS (H. J.). *The geology and petrography of the pyroxene-microdiorite of Eziator Hill, eastern Nigeria*. Schweiz. Min. Petr. Mitt., 1960, **40**, 347-358, 1 fig.

Descriptions of the different rock-types and of the alteration processes in a dioritic sill in eastern Nigeria are given.

M. W.

JACOBSON (R. R. E.), MACLEOD (W. N.), & BLACK (R.). *Ring complexes in the Younger Granite province of northern Nigeria*. Mem. Geol. Soc. London, 1958, **1**, 72 pp., 13 figs., 6 pls., 2 folding maps.

The principal rock-types (rhyolites, with 4 new analyses; biotite-granites, 7 analyses; riebeckite-granites, 7 analyses; amphibole-granites, 7 analyses; syenites and gabbros, 7 analyses) are described in detail. Analyses (with opt. data) are given for a biotite, a ferrophengite ($\text{Si}_{6.22}\text{Al}_{1.78}\text{Al}_{1.62}\text{Fe}_{0.22}\text{Fe}_{2.29}\text{Mg}_{0.02}$ with much Li & F), four riebeckites and an aegirine. The structure and field relations within six complexes are detailed (the Liruei, Buji, Amo, Rop, Sha-Kaleri, and Jos-Bukuru complexes) and shorter notes are provided for twelve other complexes. A close comparison is made with the White Mountain magma series of New Hampshire.

R. St J. L.

MILLOT (GEORGES) & DARS (R.). *L'archipel des îles de Los (République de Guinée): Une structure annulaire subvolcanique*. Notes du Serv. Géol. & Prospection Min., Dakar, 1959, pp. 49-56.

E. J. & A. S.

Petrology : structural

[NIKITIN (V. D.)] НИКИТИН (В. Д.). Строение и генезис письменных гранитов в перматитовых жилах [*The structure and genesis of graphic granites in pegmatite veins*]. Зап. Ленин. Горн. Инст. [Mem. Leningrad Mining Inst.], 1958, **33**(2), 148-182, 41 figs.

Old and new data on the mutual relation of quartz

ichthyoglypts [M.A. 2-63, 6-339] to the feldspar host, do not help fundamentally in the problem of the origin of graphic structure. More significant are the observed stages of formation of ichthyoglypts, which suggest that graphic structure is not a eutectic formation, but that it develops through recrystallization of the primary pegmatite under the influence of postmagmatic solutions.

S. I. T.

WILSON (M. E.). *Origin of pillow structure in early Precambrian lavas of western Quebec*. Journ. Geol., 1960, **68**, 97-102, 2 pls.

Observations by the author and a brief review of the literature lead to the conclusion that most pillow lavas form through the agency of water.

R. E. W.

KING (B. C.). *The form of the Beinn an Dubhaich granite, Skye*. Geol. Mag., 1960, **97**, 326-333, 3 figs.

Field evidence suggests that the Beinn an Dubhaich granite, considered by Harker to be boss-like, has the form of an undulating sheet emplaced along a folded thrust-plane.

B. W. E.

BOTT (M. H. P.) & MASSON-SMITH (D.). *A gravity survey of the Criffel granodiorite and the New Red Sandstone deposits near Dumfries*. Proc. Yorkshire Geol. Soc., 1960, **32**, 317-332, 6 figs., 1 pl.

Low gravity anomalies over the Criffel granodiorite in Scotland, indicate a batholithic shape probably continuing to a depth of more than 7 miles and having steep outward sloping contacts. The anomalies are consistent with a gradual increase in density of the granodiorite towards the S.E. margin. Isostatic balance is suspected between the large volume of low density granite and the fairly high associated topography.

B. W. E.

RODDICK (J. A.) & ARMSTRONG (J. E.). *Relict dikes in the coast mountains near Vancouver, B.C.* Journ. Geol., 1959, **67**, 603-613, 3 figs., 2 pls.

Dike-like masses of andesitic composition at some points apparently cut the host plutonic rock, yet at other points apparently are cut by the plutonic rock. They are regarded as having been emplaced as liquids derived from the host during the metamorphism of the host, and as having crystallized with a trachytic texture. In dry, less hot zones this texture was retained, while in some wetter and hotter zones a hornfelsic texture was developed. Under still more extreme conditions the texture of the dikes became granitic. On such a hypothesis of events a consistent interpretation of the otherwise confusing age relationship within the plutonic masses and the overlying extrusive rocks of the Coast mountains becomes possible.

R. E. W.

TER (FRED W., Jr.). *Chilled contacts and volcanic phenomena associated with the Cloudy Pass batholith, Washington*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B471—473, 1 fig.

The neck is situated 9 miles from the margin of the batholith but is believed to rise from its extension underground and to indicate that the batholith had ascended to a high level in the crust. The chilled rocks form in places a three-layer border zone indicative of stages of intrusion.

J. Ph.

HITTEN (E. H. TIMOTHY). *Composition trends in a granite: modal variation and ghost stratigraphy in a part of the Donegal granite, Eire*. Journ. Geophys. Res., 1959, **64**, 835—848, 5 figs., 3 tables.

Modal variations of quartz, colour index, potash feldspar/microcline, and total feldspar in 71 specimens from an area of the 'older granite' of Donegal 25 sq. mile in extent reveal previously unsuspected ghost stratigraphy. Non-linear polynomial analysis was used to compute linear and quadratic trend surfaces and deviations for each variable. With averaged data the four linear trend surfaces have almost parallel strikes in the same N-S direction as the sedimentary relics within the granitoid rocks of Thorntown to the south. These relics disappear northwards and do not occur in the area studied. The modal variations are believed to represent the ghost of a previously existing stratigraphical succession.

F. R. B.

HA (AJIT KUMAR). *On some characteristics of the quartz fabric of granitic rocks*. Proc. Nat. Inst. Sci. India, 1959, **25**, 281—291, 3 figs.

Statistical studies of quartz orientation in granitic and associated metamorphic rocks are reported. It is suggested that the presence of an 'AB' girdle, along with a poor preferred orientation of quartz might be of limited use as one of the many proposed criteria of the replacement origin of granitic rocks.

A. P. S.

RYANARAYANA (K. V.). *The Closepet Granite and associated rocks*. Indian Min., 1960, **1**, 86—108, 1 map.

The structural and stratigraphical relationships of Closepet [Bangalore] granites (quartz diorite to porphyritic granite) to associated rocks are described. In view of the discordant nature of these granites in relation to other rocks, they are considered to have formed by concordant emplacement of granitic liquid in the planes of stratification and schistosity of older rocks.

A. P. S.

GUPTA (DILIP KUMAR). *Structural studies of the porphyritic granite near Tulin, Purulia district, West Bengal*. Quart. Journ. Geol. Min. & Met. Soc. India, 1959, **31**, 63—64, 5 figs.

On the basis of structural studies the granite is regarded as magmatic.

A. P. S.

KAMB (W. B.). *Theory of preferred crystal orientation developed by crystallization under stress*. Journ. Geol., 1959, **67**, 153—170, 2 figs.

Equilibrium crystal orientations are deduced for recrystallization under directed stress of isometric, hexagonal, and rhombohedral crystals, leaving out of consideration twinning and gliding processes. With limited participation of solutions those crystals are favoured whose elastically weakest lattice directions are parallel to the greatest stress. Among uniaxial crystals four kinds of behaviour are distinguished. Quartz stands alone, in that under certain circumstances a small girdle of quartz *c*-axes may develop about the stress axis. Among isometric crystals only two kinds of behaviour are distinguished: in halite, sylvine, etc., [100] is parallel to the stress while in various metals it is [111]. In the absence of solutions different behaviours may be expected; with hexagonal and trigonal crystals, the elastically weakest lattice direction is perpendicular to the stress axis.

R. E. W.

KIZAKI (KOSHIRO). *Petrofabrics of the Oshirabetsu dome in the southern Hidaka metamorphic zone, Hokkaido, Japan*. Journ. Fac. Sci., Hokkaido Univ., 1956, ser. iv, **9**, 289—318, 51 figs.

The movement involved in the evolution of the Oshirabetsu migmatite dome may be essentially normal to lineation. A relative movement of parts has occurred whereby portions of grains, whole grains, aggregates of grains or paleosomes are displaced normal to the lineation either along the foliation plane or by rolling about B on microscopic and megascopic scale. The direction of relative movement associated with lineation at every point tends towards the centre of the dome. About 40 petrofabric diagrams based on from 81 to 299 measured orientations of grains are presented.

A. P.

SUGIYAMA (RYŪJI). *L-S fabric analysis*. Japanese Journ. Geol. Geogr., 1958, **29**, 75—98, 26 figs.

A new method of 'L-S fabric analysis' is introduced and applied to structures in several mines. It is claimed that the method can be used for predicting the variation of thickness of ore deposits. [L and S refer to lineation and schistosity.]

A. P.

BATTEY (M. H.). *The relationship between preferred orientation of olivine in dunite and the tectonic environment*. Amer. Journ. Sci., 1960, **258**, 716—727, 7 figs.

A petrofabric study of 7 dunites from Dun Mountain,

Nelson, New Zealand, showed that the optical γ (crystallographic c) axes tend to be oriented parallel to the tectonic B -axis, while α (crystallographic b) tends to lie in the axial plane of upright folds, or may tend to form, with β , a girdle in the tectonic AC plane.

H. W.

WEEDON (D. S.). *The Gars-bheinn ultrabasic sill, Isle of Skye*. Quart. Journ. Geol. Soc. London, 1960, **116**, 37-54, 2 figs., 4 pls.

A 250-foot thick sill of feldspathic peridotite shows in the topmost 50 feet well-developed regular banding of alternating feldspar-rich and olivine-rich layers. The former are composed largely of pegmatitic crystals, and the feldspathic bands become more frequent and thicker upwards. Three new chemical analyses, of the chilled margin of the dyke feeder to the sill, and of a feldspathic band and its subadjacent olivine-rich band, show that differentiation into layers occurred mainly by the gravitational settling of olivine from a magma approaching picrite in composition. Comparison is made with other igneous bodies showing pegmatitic development, and the probable mechanism responsible for the differentiation and production of the banding is discussed.

B. C. M. B.

TAUBENECK (WILLIAM H.) & POLDERVAART (ARIE). *Geology of the Elkhorn Mountains, northeastern Oregon: Part 2. Willow Lake intrusion*. Bull. Geol. Soc. America, 1960, **71**, 1295-1322, 15 figs., 4 pls.

The Willow Lake intrusive is funnel-shaped with a sheetlike appendage. Normal metagabbroic rocks, rhythmically layered rocks similar to those described from the Stillwater and Skaergaard intrusions, and abnormal layered rocks in which the minerals are elongated and arranged with their longer axes at high angles to the layering, are described. Modal analyses and five chemical analyses are given. Excellent photographs illustrate the discussion of the origin of the layering. The Willow Lake type of rhythmical layering cannot have resulted from a process combining gravitative sedimentation of crystals with convection currents in the magma, such as accounts for Skaergaard-type layered rock. It is believed to have formed as the result of undercooling and crystallization in the oversaturated region, while convective and turbulent currents were intermittently active, in a magma which was nearly in a univariant condition. The role of diffusion in the interstitial melt is discussed, and the formation of monomineralic layers in the layered rocks is attributed to diffusion between interstitial melts of adjacent layers of contrasting mineralogy and reactions between the melts and the surrounding solid phases. [M.A. 15-61]

A. L. A.

Petrology: petrogenesis

OELSNER (O.). *Bemerkungen zur Bedeutung von Assimilationsvorgängen bei der Intrusion initialer Magmen zur Genese oxydischer Geosynklinallagerstätten*. Rept. 21 Intern. Geol. Congr., Norden, 1960, Part **16**, 29-45 figs.

The mechanism of intrusion of magma and the possible effect of assimilation are discussed. From a consideration of the heat balance it is concluded that about 52% of the intruded volume of country rock can be assimilated. The influence of the stratification of not thoroughly consolidated argillaceous country rocks on ascending ore solutions is discussed by reference to experimental studies. R. A. H.

MEHNERT (K. R.). *Über endogene Erzbildung und ihre Beziehungen zur Granitentstehung durch selektive Mobilisation*. Neues. Jahrb. Min., Abhandl., 1960, **9**, 49-76, 1 fig.

The possible formation of granite and of ores through selective mobilization with rising PT conditions, magmatic differentiation with decreasing PT conditions and (c) metasomatic blastesis of K-feldspar at essentially constant PT conditions are discussed. Ore formation through selective mobilization is only possible under relatively low PT conditions and high water content. Metasomatic blastesis of K-feldspar does not appear to lead to ore formation.

R. A. H.

BARTH (TOM F. W.). *The Bowen reaction series and development of different magma types*. Indian Min., 1960, **24-28**, 2 figs.

The reaction series in basalts cannot be interpreted by Bowen's reaction diagram; the development of ferromagnesian reaction series depends on the presence of other ions in the magma. Some interaction between feldspar and ferromagnesian series is however admitted. A. P. S.

ERNST (W. G.). *Diabase-granophyre relations in the Endicott Sill, Duluth, Minnesota*. Journ. Petr., 1960, **1**, 286-305 figs., 4 tables.

The gently dipping, 1500 ft. thick sill is composed of diabase grading through granodiorite into granophyre although the relationships are those of a composite series. Field and petrographic studies show that the acid rocks are probably produced by crystal fractionation of the basic magma. The relative volumes of the rock types (only 60% diabase) seen at the present level of erosion do not support a theory of fractionation *in situ*, and it is suggested that some of the granophyre differentiate may have migrated up-dip to intrude, and partly react with, the diabase. The cryptoperthitic alkali feldspar (about $Or_{62 \pm 5}$ in t

anodiorite and $\text{Or}_{67\pm5}$ in the granophyre) has been heated and examined by X-rays, and it is concluded that it crystallized above 600°C at a water pressure of about 1000 ± 500 bars. G. M. B.

ALLEY (C. E.). *Kilauea magma 1959-60*. Geol. Mag., 1960, **97**, 494-497, 2 figs., 2 tables.

Two new chemical analyses show that the first phase of the 1959-60 eruption of Kilauea was picritic, with the later lava more basic than the earlier; both lavas fall on the Kilauea line [M.A. 14-436]. Calculation of the type of fractionation necessary to explain the compositional variation in the products of the 1955 eruptions shows that separation of plagioclase and pyroxene is principally responsible for the differentiation. B. C. M. B.

ALLEY (C. E.) & SCOON (J. H.). *Differentiation of Hawaiian basalts. Trends of Mauna Loa and Kilauea historic magma*. Amer. Journ. Sci., 1961, **259**, 60-68, 4 figs., 4 tables.

Nine new analyses of basaltic rocks from Kilauea and Mauna Loa, Hawaii Island, and one of a rock from the Koolau dome of Oahu strengthen the conclusions that the historic lavas of Kilauea and Mauna Loa are derived from different magma chambers, and that hypersthene in the lavas is related to the tenor of lime and silica. Lavas from Mauna Loa have generally more silica and less lime and alkalis than those from Kilauea. [M.A. 14-436, and preceding abstract] H. W.

UNO (HISASHI). *High-alumina basalt*. Journ. Petr., 1960, **1**, 121-145, 10 figs., 6 tables.

The aphyric high-alumina basalts of Japan and neighbouring areas are compared with aphyric tholeiites and alkali basalts from the same region, with reference to their chemistry, general mineralogy, and occurrence. Plots of Al_2O_3 against $\text{Na}_2\text{O}+\text{K}_2\text{O}$, for various ranges in SiO_2 content, show the high-alumina basalt to be transitional between the other two. New analyses of two high-alumina basalts and one mugearite are presented. The groundmass mineral assemblage also supports the term 'transitional basalt' and two new analyses of groundmass augites show them to be much more calcic than those from tholeiites. The fractionation trends of high-alumina basalt are considered, two new analyses from the differentiated Huziow being compared with four new analyses of the differentiated Sidara alkali dolerite sheet. The high-alumina basalt is shown to occur in a zone extending between the tholeiite and alkali provinces of the Japanese islands, and it may represent a primary magma derived by partial melting of the peridotite mantle at depths intermediate between those of tholeiite and alkali basalt production, say at about

200 km. On this hypothesis the apparent absence of high-alumina basalt from oceanic regions presents a problem which is discussed. The position of the 'andesite line' in this region is revised. [M.A. 14-367] G. M. B.

JOPLIN (G. A.). *On the tectonic environment of basic magma*. Geol. Mag., 1960, **97**, 363-368.

An attempt is made to show that basic magma occurs predominantly in stable (oceanic or continental) regions, associated with vertical and not with folding movement; where basic rocks occur in orogenic belts they form flows or intrusions belonging to the geosynclinal sinking phase of the orogenic cycle. It is argued that rocks of the appinitic suite are formed from the stable region basic rocks by a process of hybridization during a subsequent folding phase, without introduction of further basic magma [M.A. 14-515]. A classification of rock-types according to tectonic environment is proposed—the 'Non-orogenic Association' corresponds to the Volcanic Association of Kennedy and Anderson, with the exception of the andesites; the 'Orogenic Association' includes all the rocks of the Plutonic Association with the addition of the andesites. B. C. M. B.

[BUTAKOVA (E. L.)] Бутакова (Е. Л.). О роли метасоматоза в образовании щелочных пород [On the role of metasomatism in the formation of alkaline rocks]. Мин. сборник Львов. геол. общ. [Min. Mag. Lvov Geol. Soc.], 1959, **13**, 282-290, 8 figs.

Contact metasomatism and 'autometasomatism' of certain alkaline intrusive rocks from northern Siberia are discussed. Textural details of nephelinization and aegirization are described. N. R.

NIYOGI (DIPANKAR). *Structural pattern of the Kishengarh alkaline rocks*. Quart. Journ. Geol. Min. Met. Soc. India, 1960, **32**, 27-38, 9 figs.

On the basis of structural observations, the nepheline syenites and related alkalic gneisses are considered to have originated by replacement in situ of lime-rich, amphibole-biotite schists. A. P. S.

SMULIKOWSKI (K.). *Zagadnienia genetycznej klasyfikacji granitoidów* [Problems of genetic classification of granitoids]. Studia Geol. Pol., 1958, **1**, 1-58, (Polish with English summary).

Four main genetic groups of granitic rocks are distinguished, and two groups are subdivided: I, Metamorphic, formed by metasomatism and recrystallization of older rock complexes mainly of sedimentary origin; II, Rheomorphic, of origin similar to I, but fairly mobile and forming intrusions of diapiric type; III, Magmatic, crystallized

from secondary magma representing dense suspensions of crystals in a liquid phase; these can be further subdivided on the basis of character of primary material into palinogenetic (from secondary fusion of subcrustal rock complexes), regenerative (from secondary fusion of older granitoids), differentiated (from end stage liquid from crystallization of basaltic magma); IV, Mixed, subdivided into syntectic (formed by mixing of granitoid magma with wall rock during intrusion), anatectic (formed by mixing palinogenetic magma with refractory rocks of the complex from which by selective fusion it was derived). The author discusses various criteria for distinguishing the above-mentioned groups and quotes specific examples from the Sudeten Mountains and their foreland. W. S.

KARDYMOWICZ (I.). *Przejawy granityzacji amphibolitu* [On the granitization of amphibolites]. *Roczn. Pol. Tow. Geol.*, 1958, **27**, 75–149.

Crystalline rocks around Korzec [Koretz], Ukraine, include the pink granite of Futory Starokoreckie, and amphibolites, diorites, granodiorites, and grey granites from Gwozdow and Holyczowka. The granite of Stary Korzec is interpreted as a part of large batholith. Evidence is presented for granitization of amphibolites with the formation of grey granite as an end product. Analogy is drawn between the rocks of Korzec and rocks from south and south-eastern Finland. The minerals for which chemical analyses are given include biotite from granite (Gwozdow), biotite and amphibole from diorite (Holyczowka); numerous analyses of granites, diorites, aplites, and amphibolites from Gwozdow and Holyczowka are presented. W. S.

SAHA (AJIT KUMAR). *The structural and petrological evolution of the diorite of eastern Manbhum*. *Quart. Journ. Geol. Min. & Met. Soc. India*, 1959, **31**, 91–113, 20 figs.

On the evidence from field studies and petrographical examination, the diorites and granodiorites are considered to have been formed by metasomatism of older basic rocks and gabbros induced by granitic fluids. Six chemical analyses of rocks and the optics of several minerals are detailed. A. P. S.

BOSE (MIHIR KUMAR). *On the gneissic granite of Champua, Keonjhar, India*. *Proc. Nat. Inst. Sci. India*, 1960, **26A**, 143–151, 9 figs, 2 pls.

Field and laboratory data on a granite body are given; its formation is attributed to a slow process of feldspathization. A. P. S.

OGURA (YOSHIO). *On the granitization of some basic rocks of the Gosaisho-Takanuki District, southern Abukuma Plateau, Japan*. *Japanese Journ. Geol. Geogr.*, 1958, **29**, 171–198, 18 figs., 1 pl., 9 tables.

Two series of granitization process are distinguished; an amphibolite-quartz-diorite series and a metadiabase-trondhjemite series. Four analyses of rocks representing the former and six representing the latter are reported. Chemical analyses and optical properties are presented for the hornblendes and biotites of each of the four analyzed rocks in the amphibolite-quartz-diorite series. Spectrographic determinations of Ba, Pb, Sr, Zn, Co, Ni, Li, S, As, V, Cr, Ga, and Ge content are given for the plagioclase, biotite, hornblende, and magnetite of these four rocks and for the plagioclase in the six analyzed rocks of the metadiabase-trondhjemite series. A. P.

KORZHINSKY (D. S.). *Acidity-alkalinity in magmatic processes*. Rept. 21st Intern. Geol. Congr., Norderney, 1960, Part **21**, 160–170, 3 figs.

With increasing alkalinity of a magma, the activity coefficients of bases, especially the stronger ones, increase and those of silica decrease. Granitization is a magmatic replacement produced by flows of transmagmaic solution ascending from depth; at such depths these solutions and the magmas generated by them are strongly alkaline. The alkalinity of transmagmaic solutions increases as they penetrate into more basic rocks; thus in the granitization of basic rocks subalkaline and alkaline magmas are formed. R. A. H.

[NIKITIN (V. D.)] Никитин (В. Д.). Процессы перекристаллизации и метасоматоза в слюдоносных и керамических пегматитах [*The processes of recrystallization and metasomatism in mica-bearing and ceramic pegmatites*]. *Записки Ленин. Горн. Инст.* [Mem. Leningrad Mining Inst.], 1952, **27**(2), 107–157, 17 figs.

— — — Особенности образования кристаллов мусковита в пегматитовых жилах [*Certain features in the formation of muscovite in pegmatite veins*]. *Ibid.*, 1953, **29**(2), 3–31, 42 figs.

— — — К теории генезиса пегматитов [*On the theory of formation of pegmatites*]. *Ibid.*, 1955, **30**(2), 44–111, 20 figs.

These three papers present a continuous discussion relating to the genesis of pegmatites based on the author's studies of pegmatites from Karelia and the Mama region of Siberia. A detailed review and criticism is presented of the principal hypotheses dealing with origin of pegmatites and a new hypothesis is outlined. According to this hypothesis, which is succinctly presented on two geochemical-paragenetic diagrams, the intrusion of a mobile granitic magma passes first through the phase of direct crystallization mainly as a quartz-feldspar-mica aggregate. This phase is followed by the phase of recrystallization under the influence of post-magmatic supercritical fluid.

then follows the phase of metasomatism during which the supercritical fluid passes into a hydrothermal solution. This work, besides presenting the views of the author, is of great interest for its detailed criticism of the views of A. E. Fersman, K. A. Vlasov, V. A. Nikolaev, D. S. Korzhinsky, and A. N. Zavaritzky on the genesis of granite pegmatites. S. I. T.

TECHON (BRIAN). *The geochemistry, mineralogy, and origin of pegmatites from three Scottish Precambrian metamorphic complexes*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 17, 36–52, 9 tables.

Pegmatites from the Scourian, Laxfordian, and Moinian metamorphic complexes are examined with regard to mineral content, internal zoning, and the minor element content of their minerals. Scourian pegmatites are characterized by more abundant hornblende than biotite, by enrichment in Co and Ni, and impoverishment in Ba, Sr, and Tl. Laxfordian pegmatites are enriched in Ba, Cr, Pb, Sr, Tl, and V; they consist of sharply bordered zones, and biotite is more common than hornblende and muscovite. The Moinian pegmatites differ from both the Scourian and Laxfordian pegmatites by abundance of muscovite, internal zoning, the presence of tourmaline and garnet, enrichment in Sn, and impoverishment in Co, Ni, and V. The variations in the minor element content of the minerals are due to original differences in the initial magmas, which may have originated from fusion of the country rock at depth during metamorphism. H. M.

RYNA (JENARO GONZÁLEZ). *Las pegmatitas graníticas de Santa Ana, Telixtlahuaca, Oax., México*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 17, 63–76, 4 figs.

The granite pegmatites of Santa Ana, Telixtlahuaca, Oaxaca, Mexico, are found in Palaeozoic granitic gneisses. They are worked for feldspar and quartz. From these pegmatites radioactive minerals have been identified for the first time in Mexico. They are allanite and fergusonite, the latter with a maximum radioactivity of 8.57% [^{232}Th]. Th varies from 1 to 10% and rare earths can reach 0.5% in allanite. H. M.

OFFER (DONALD H.). *Pegmatite-granite relationships in the Calamity Peak area, Black Hills, South Dakota, U.S.A.* Rept. 21st Intern. Geol. Congr., Norden 1960, Part 17, 77–93, 9 figs., 2 pls.

The Black Hills uplift of Palaeozoic and Mesozoic rocks, north-central United States, has a Precambrian schist core. Pegmatites occur in the schist surrounding a large granite unit. All transitional types, from pegmatite dykes in granite to rare mineral pegmatites in schist, are

observed. The granite unit is formed of numerous somewhat tabular granitic masses in schist. Each mass consists of alternate 3-inch thick layers of potash pegmatite and colour-laminated, medium-grained, soda granite. The pegmatite-granite content of the area increases toward the centre of the unit as schist screens decrease in size and number. Schistosity is anticline-like and steeply south-plunging. Schistosity, granitic masses, and internal layering are generally concordant. The Calamity Peak mass, which is domal with a discordant core, has quaquaversal layering discordant to the schistosity in its northern half. The layering is probably the key to pegmatite genesis. Magmatic and granitization origins for the layering fail to explain the observations; an injection-assimilation hypothesis is favoured. H. M.

REITAN (PAUL H.). *The genetic significance of two kinds of basified zones near small pegmatite veins*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 17, 102–107, 2 figs.

Two types of zones of basification near small pegmatite veins in regionally metamorphosed rocks are observed: (1) immediately adjacent to, and (2) at a short distance from the pegmatites. Pegmatite veins associated with basified zones of these types were formed in low pressure spaces by lateral secretion from the wall rock. In extremely competent rocks zones of pressure maxima may exist at a short distance from the pegmatites and pegmatite veins are therefore surrounded by basified zones of type (2). In less competent rocks such pressure maxima did not exist and basified zones of type (1) were formed. H. M.

BOULANGER (DOMINIQUE) & DEICHA (GEORGES). *Rapports entre phase hydrothermale et pneumatolytique dans la formation des pegmatites*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 17, 108–110.

Quartz from graphic granite in pegmatites at Sementina, Ticino, Switzerland, and at Labour, Basses Pyrénées, France, has cavities containing mainly either strongly condensed CO_2 or water. Experiments do not prove gas inclusions to be older than water inclusions. Theoretical consideration shows that pneumatolytic as well as hydrothermal phases are results of the differentiation of an intermediate phase, a differentiation which is controlled both by pressure and by temperature. H. M.

GINZBOURG [GINZBURG] (A. I.). *Specific geochemical features of the pegmatitic process*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 17, 111–121, 2 tables.

A general presentation of the geochemical features of the development of rare-metal granitic pegmatites in the U.S.S.R. is given. The geochemical data confirm A. E.

Fersman's view that pegmatites were initially formed from residual melts and later went through successive stages of crystallization by metasomatic processes. H. M.

MICHEESEN (HARRY I.). *Pegmatites in the Precambrian of Bornholm, Denmark*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 17, 128–136, 6 figs.

On the island of Bornholm in the Baltic Sea, pegmatites were formed during a late stage of a regional granitization at amphibolite facies conditions. According to structural relationships between pegmatites and host rocks, the mode of formation of the pegmatites varied in accordance with the degree of granitization. In the centres of granitization, pegmatites are irregularly shaped, diffusely bounded, and often well-zoned replacement bodies. Adjacent to the centres diffusely bounded, often zoned, pegmatite veins usually show irregular pinch and swell structures. Away from centres of granitization the mostly unzoned pegmatites were formed by selective replacement, a process by which the light minerals were resorbed and the dark minerals pushed aside, so that basic fronts, conformable foliation, and pinch and swell structures arose. Furthest from the centres the often zoned pegmatites were, for the most part, formed during dilation. The author has later used the expression 'selective resorption' instead of 'selective replacement'.] H. M.

Sedimentary petrology : general.

SHIPEK (CARL J.). *Photographic study of some deep-sea floor environments in the eastern Pacific*. Bull. Geol. Soc. America, 1960, 71, 1067–1074, 1 fig., 5 pls.

Colour photographs taken by means of a specially designed deep-sea camera at depths in excess of 4500 metres clearly show microrelief and ripple marks, as well as manganese nodules. A. L. A.

NAWARA (K.). *Analiza kształtu otoczków w górnym biegu Dunajca i jego dopływach na Podhale* [Analysis of the shape of pebbles in the upper course of Dunajec River and its Podhale tributaries]. Inst. Geol. Mus. Ziemi, Warszawa, 1960, pp. 1–35, 9 figs., (English summary).

The author's investigations on the shape of pebbles in the upper Dunajec indicate that discoidal and spheroidal forms are predominant among pebbles of different composition and texture. The final shape of pebbles is mainly controlled by current velocity, river gradient, and quantity as well as quality of the transported material. W. S.

GRIFFITHS (J. C.). *Modal analysis of sediments*. Rev. de Géogr. Phys. et de Géol. Dynam., 1960, 3, 29–48, 5 figs.

The technique of point-counting is applied to sedimentary rocks and a classificatory code suggested as suitable for a

number of rocks includes the classes quartz, feldspar, rock fragments, matrix, and cement. Examples are taken from a greywacke and a sandstone and the frequencies of various minerals are statistically analysed. R. A. H.

FLINT (R. F.), SANDERS (J. E.), & RODGERS (JOHN). *Symmettite : a name for nonsorted terrigenous sedimentary rocks that contain a wide range of particle sizes*. Bull. Geol. Soc. America, 1960, 71, 507–510.

Symmettite is proposed for the sediment, symmettite for the lithified equivalent. A. L. A.

SHIKI (TSUNEMASA). *Studies on sandstones in the Maizuru zone, southwest Japan. I. Importance of some relations between mineral composition and grain size*. Mem. Coll. Sci., Univ. Kyoto, 1959, ser. B, 25, 239–246, 5 figs.

The relations between quartz content, feldspar content and mean size are shown in graphs and discussed in terms of the concept of maturity of the sediments. A. P.

MIDDLETON (G. V.). *Chemical composition of sandstones*. Bull. Geol. Soc. America, 1960, 71, 1011–1026, 4 figs.

In a collection of 168 chemical analyses (from the literature) analyses with less than 5% Al_2O_3 were grouped as 'quartzite clan'; the remaining analyses were divided by their regional relations into three tectonic groups—taphrogenic, eugeosynclinal, and others, mainly exogeosynclinal. Arithmetic and geometric means and histograms for the seven major oxides for the four groups are presented as well as variation diagrams for $\text{K}_2\text{O}/\text{Na}_2\text{O}$ and $(\text{K}_2\text{O} + \text{Na}_2\text{O})/\text{Al}_2\text{O}_3$. The tectonic associations group together clans of chemical analyses which differ significantly from each other. The eugeosynclinal graywackes, in particular, differ from other sandstones by their low $\text{K}_2\text{O}/\text{Na}_2\text{O}$ ratio which is correlated with the presence of mafic volcanic detritus. A. L. A.

GRAF (D.). *Geochemistry of carbonate sediments and sedimentary carbonate rocks—Part I : Carbonate mineralogy. Carbonate sediments*. Circ. Illinois State Geol. Survey, 1960, 297, 39 pp., 1 fig., 3 tables.

— — — *Part II : Sedimentary carbonate rocks*. Op. cit., 1960, 298, 43 pp., 6 figs., 4 tables.

— — — *Part III : Minor elements distribution*. Op. cit., 1960, 301, 71 pp., 3 figs., 38 tables.

— — — *Part IVA : Isotopic composition chemical analyses*. Op. cit., 1960, 308, 42 pp., 4 tables.

— — — *Part IVB : Bibliography*. Op. cit., 1960, 305, 55 pp.

In Part I the distribution of the major and minor elements in sedimentary distributive mechanisms and the presence

environments are considered. In Part II the mineral and chemical compositions of carbonate rocks of various type and origin are discussed. In Parts III and IV the minor and trace elements and the O, C, and Mg isotopes, respectively, are studied with 98 chemical analyses presented in Pt. IVA. The bibliography contains 938 references.

W. A. Wh.

Sedimentary mineralogy.

ALL (CAROL I.). *Methods of study of sand and silt from soils*. Canad. Min., 1959, **6**, 363–371.

Methods of segregating and identifying the minerals in fine sands and silts from Ontario using heavy liquids, micrographic and binocular microscopes, the Frantz isodynamic separator, staining methods for K-feldspars, and index of refraction oils are described. Brief descriptions are given of the 35 minerals observed.

R. B. F.

ALKER (THEODORE R.). *Carbonate replacement of detrital crystalline silicate minerals as a source of authigenic silica in sedimentary rocks*. Bull. Geol. Soc. America, 1960, **71**, 145–152, 2 figs., 2 pls.

Investigation of three different rock suites indicates that authigenic siliceous features commonly occur in or near strata that contain detrital silicate minerals partially or completely replaced by calcite. This association suggests that silica released by calcite or dolomite replacement of silicate minerals may be an important source of authigenic silica in some sedimentary rocks.

A. L. A.

WELL (NORMAN D.), PURDY (EDWARD G.), & IMBRIE (JOHN). *Bahamian oolitic sand*. Journ. Geol., 1960, **68**, 481–497, 3 figs., 4 pls.

An 'ooid' is defined as a sand-size grain showing a concentrically laminated envelope around a nucleus, and an 'oolite' as a sediment or sedimentary rock containing a significant proportion of ooids. The present study of oolite deposits of the Great Bahama Bank shows that they are being formed in a marginal zone of very shallow water, apparently most rapidly at depths less than six feet. The aragonite layers are thought to be deposited metastably due to loss of CO₂ when cool tidal current water mixes suddenly with warm shallow water. Concentric unpigmented laminae are composed of aragonite crystals with tangential orientation of their *c*-axes. Pigmented lamellae and blebs are composed mainly of unoriented crystal aggregates, with varying amounts of organic matter.

R. E. W.

UDEFOY (C.). *Hypothèse sur la formation des phénomènes cristallins de dolomite au voisinage des cours d'eau salés du Maroc*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1191–1199, 1 pl.

It is suggested that dolomite crystals, originally formed as small inclusions in salt deposits, were liberated by solution of the salts by water from a nearby river. Some dolomite crystals increased considerably in size at the expense of the rest by a process of alternating solution and recrystallization in which twinning appears to have had a significant effect.

R. A. H.

SCHROLL (E.) & WIEN (P.). *Eine rezente Bildung von Dolomit im Schlamm des Neusiedler Sees*. Tschermaks Min. Petr. Mitt., 1960, ser. 3, **7**, 286–289, 1 fig.

Bottom muds of the very shallow and somewhat saline Neusiedler Lake, Burgenland, eastern Austria, consist of newly precipitated dolomite, protodolomite, and calcite. Protodolomite [M.A. 13–88, 270] is lacking in the lower part of the 60 cm mud profile which has been examined.

A. P.

RAPSON (JUNE E.). *Euhedral magnesite in Palaeozoic sediments from Saskatchewan*. Canad. Min., 1959, **6**, 394–397, 2 figs., 1 table.

FERGUSON (R. B.). *The morphology of the magnesite crystals*. Ibid., 1959, **6**, 397–399, 2 figs.

Colourless and red hematite-stained prismatic crystals up to 2 mm in length were found in oil-well drill cuttings from Silurian–Devonian rocks near Weyburn, Sask. X-ray powder and refr. ind. examination showed the crystals to be magnesite with the unusual combination of forms, hexagonal prism {11 $\bar{2}$ 0} and pinacoid {0001}, and sometimes very small rhombohedron {10 $\bar{1}$ 1}.

R. B. F.

CHAO (E. C. T.) & DAVIES (WILLIAM E.). *Authigenic rhodochrosite spherules from Gardner Creek, Kentucky*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B446–447, 1 fig.

The mineral occurs in orange-yellow, clayey quartz silt which contains about 0.5% of heavy minerals. About 20% of the heavy fraction is rhodochrosite, the remainder is goethite, chromite, leucosene, and tourmaline. The spherical rhodochrosite grains are about 0.1 mm diam., pale yellowish to reddish brown in colour; refr. ind. $n_D^{20} = 1.815$, $n_F = 1.598$ (both ± 0.002) indicate a nearly pure rhodochrosite [M.A. 9–124]; unit cell dimensions are $a = 4.78$, $c = 15.82$ Å.

K. S.

MILLOT (GEORGES) & PALAUSI (GUY). *Sur un talc d'origine sédimentaire*. C.R. Somm. Soc. géol. France, 1959, pp. 45–46.

In strata at the base of the Primary of the French Sudan and Haute Volta (Fr. W. Africa) lenses of dolomitic limestone are distributed irregularly in the sandstones. In

studying the heavy minerals a residue of white soapy powder was obtained from oolitic specimens. Chemical and X-ray examination proved this powder to be a mixture of quartz and talc. Under the microscope the talc forms the centre and builds thin scales in the concentric layers of the oolith. The talc is of sedimentary, possibly authigenic, possibly diagenetic origin.

E. J. & A. S.

ALDERMAN (A. R.) & VON DER BORCH (C. C.). *Occurrence of hydromagnesite in sediments in South Australia*. *Nature*, 1960, **188**, 931.

The surface layers of the sediment in a lagoon off the Coorong, South Australia, was found to consist essentially of aragonite and hydromagnesite. The hydromagnesite decreases with depth and has not been detected below 9 inches.

M. J. Le B.

OVEY (C. D.) & GAY (P.). *The discovery of fluorite and perovskite in the Upper Oxford Clay at Warboys, Huntingdonshire*. *Proc. Geol. Assoc.*, 1960, **71**, 340.

Black octahedral crystals in the clay were proved by X-ray diffraction to consist of fluorite coated with perovskite.

M. G. B.

MILTON (C.), CHAO (E. C. T.), FAHEY (J. J.), & MROSE (M.). *Silicate mineralogy of the Green River formation of Wyoming, Utah, and Colorado*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **21**, 171-184, 13 figs.

The Eocene lacustrine beds of the Green River formation contain calcareous or dolomitic mudstones, with interbedded tuffs which are overlain by deposits of trona or nahcolite. These beds have not been subjected to any contact or regional metamorphism and contain hydrocarbons and unaltered fossils, yet they contain authigenic minerals, known elsewhere only in alkali pegmatites, etc., which are believed to have formed in the Green River formation under moderate pressures and low temperatures (probably under 200°C). The well-defined authigenic silicates here discussed include acmite, albite, analcime, elpidite, garrelsite, labuntzovite, leucosphenite, loughlinite, reedmergerite, searlesite, and sodic amphibole (magnesian riebeckite) [*M.A.* **14**-343, 490, 501, **15**-68].

R. A. H.

VANDERSTAPPEN (R.) & VERBEEK (T.). *Présence d'analcime d'origine sédimentaire dans le mésozoïque du bassin du Congo*. *Bull. Soc. belge Géol.*, 1959, **68**, 417-421.

Analcimolite has been discovered in two borings, one at Samba, Equator Province, the other at Dekese, Kasai Province. The rocks and their occurrence are described, and X-ray powder photographs figured. The origin is briefly discussed. [Analcimolites—rocks in which analcime is the principal constituent—were described first from the central

Sahara by Joulia (F.), *et. al.*, *Bull. Serv. Carte géol. d'Alsace*, 1958, **11**, 67].

F. Sch.

ZEN (E-AN). *Early stages of evaporite deposition*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B458-461, 2 figs.

K. S.

HUNT (CHARLES B.). *The Death Valley salt pan, a study of evaporites*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B456-458, 1 fig.

The orderly arrangement of the salts is discussed. K. S.

[FEODOT'EV (K. M.)] ФЕОДОТЬЕВ (К. М.). Очерки геохимии солей. Геохимические диаграммы соляных отложений [Outlines of the geochemistry of salts. Geochemical diagrams of salt deposits]. Труды института геологических рудных месторождений, петрографии, минералогии и геохимии [Trans. Inst. Geol. of Ore-deposits, Petrography, & Geochem.], 1959, **28**, 22-42, 9 figs.

This work is based on data relating to the crystallization of salts in saline lakes and seas, as well as on the record of salt deposits. The order of crystallization of various minerals in different types of occurrences is illustrated by means of geochemical paragenetic diagrams. Special attention is paid to the elucidation of the prevailing climatic and geological conditions during the process of deposition of salts.

S. I. T.

[PEREL'MAN (A. I.)] ПЕРЕЛЬМАН (А. И.). Некоторые вопросы геохимии катагенеза в осадочных месторождениях типичных «медистых» песчанников [Certain problems of the geochemistry of catagenesis in sedimentary deposits of the type of 'cupriferous' sandstones]. Труды института геологических рудных месторождений, петрографии, минералогии и геохимии [Trans. Inst. Geol. of Ore-deposits, Petrography, & Geochem.], 1959, **28**, 5-21.

'Catagenesis' is a new term applied to the geochemical activity of ground waters. The author discusses catagenesis in red deposits of desert formation and especially the geochemical activity of soda lake waters. Migration and deposition of copper and other metals are discussed.

S. I. T.

CARROLL (DOROTHY). *Role of clay minerals in the transportation of iron*. *Geochim. Cosmochim. Acta*, 1960, **14**, 1-28, 5 figs.

Iron is associated with clay minerals as an essential substitute ion within the lattice, or externally as an oxide coating. Changes in the clay mineral environment, particularly changes of pH and/or Eh, affect the status and mobility of the iron. Experiments have been made, using nontronite and (with iron oxide coatings) kaolinite and

pyosite, to study the removal of iron from clay minerals reducing conditions produced by bacteria in three natural environments—freshwater anaerobic, marine aerobic, marine non-type anaerobic. The stability of several clay minerals in sea-water with and without H_2S has also been studied experimentally. Fe_2O_3 is removed at Eh +0.215 in fresh water and Eh +0.098 in sea water. Bacterial activity seems to be necessary to maintain the reducing conditions in the environments studied. Iron associated with clay minerals is an important factor in the transportation of iron to sedimentary basins of deposition.

R. C.

Sedimentary petrology, regional

KKOLA (T.). *Sedimentation of quartzite in the Kemi area, north Finland*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 9, 154–161, 9 figs.

The Precambrian quartzites have been described as having been water-laid on the western side of the Kemi river and as wind-blown deposits on the eastern side. Current bedding and ripple marks show that both formations are water-laid sediments: 500 measurements on cross-bedding show that the direction of transport is the same in both quartzites.

R. A. H.

YLLOR (JOHN C. M.). *The clays and heavy minerals of the Shotover Ironsand series* [Oxfordshire & Buckinghamshire]. Proc. Geol. Assoc., 1959, 70, 239–253, 2 figs., 3 pls.

From d.t.a. and c.e.c. measurements the clay mineral is identified as a typical kaolinitic fireclay, with occasional illite in addition. The main heavy minerals present are zircon, tourmaline, rutile, kyanite, staurolite, limonite, and leucoxene, with minor amounts of sillimanite, garnet, and anatase. It is suggested that the raw material of the Shotover Ironsands was provided by re-working of the local Upper Jurassic rocks.

M. G. B.

VELZEL (P. VAN), OVERWEELE (C. J.), & VEENSTRA (H. J.). *Geological investigations on boulder clay of E. Groningen*. Leidse Geol. Mededelingen, 1959, 24, 721–759, 4 figs., 5 pls., 6 tables.

By different geological methods grey boulder clay, glacial sands, and black humic clay ('potklei'), which occur in the ice-pushed nuclei of drumlins in E. Groningen, were examined. As well as palynological and micro-fossil investigations, granulometric analyses and countings of minerals have been made. Detailed descriptions of the facies are given. The boulder clay proved to be of the normal grey type, occurring in Holland, with a local association of erratics.

P. C. Z.

CROMMELIN (R. D.). *A contribution to the sedimentary petrology of the Dollart as compared with adjoining areas*. Verh. Kon. Ned. Geol. Mijnb. k. Gen., 1960, geol. ser., 19, Symposium Ems-Estuary (North-Sea), 135–145, 4 figs., 4 tables.

Garnet, epidote, and amphibole are the main minerals in the heavy mineral association of the Dollart area s.l. This association agrees with that of the so-called A-province, which is characteristic for the adjacent part of the North Sea. The heavy minerals of several portions of the Dollart area are compared with those of the neighbouring sediments.

P. C. Z.

LIÉGEAIS (P. G.). *Stalactites composites*. Bull. Soc. belge Géol., 1959, 68, 117–122, 1 fig.

The author records the occurrence in the Frasnian of Solre-Saint-Géry, Belgium, of stalactites which show alternating layers of calcite and limonite. An explanation of the phenomenon is given.

F. Sch.

ADERCA (B. M.), BIOT (A.), & SCHEERE (J.). *Une sidérose à sphérules de kaolinite et un schiste à sphérolithes de sidérite formant horizon-repère*. Bull. Soc. belge Géol., 1959, 68, 251–257, 2 figs., 1 pl.

The authors report on the lateral extension of two lithological horizons from the Coal Measures of Charleroi, zone de Genk, Belgium. One of them, found in the roof of a coal seam some thirty meters above the marine horizon of Wasserfall, is a clay-ironstone containing small spherules of kaolinite. It has a known extension of about 12 km. [M.A. 14–229]. The other is a spherulitic mudstone found below the same coal seam. It has a known extension of about 4 km.

F. Sch.

JEDWAB (J.). *Présence de grès uranifère à Argenteau (prov. de Liège)*. Bull. Soc. belge Géol., 1959, 68, 319–323.

A grey sandstone, slightly radioactive, with fossil plants and coaly debris occurs at Argenteau. The rock is described. The coaly debris was separated and analysed for U. The U content, 185–210 p.p.m., is much higher than in the whole sandstone.

F. Sch.

JENNY (V.) & QUERVAIN (F. DE). *Untersuchungen von Kalk- und Dolomitgehalt an Sanden quartärer Ablagerungen der Nordostschweiz. I. Teil*. Schweiz. Min. Petr. Mitt., 1960, 40, 55–67, 5 figs., 1 map.

M.W.

ERNST (W.), KREJCI-GRAF (K.), & WERNER (H.). *Parallelisierung von Leithorizonten im Ruhrkarbon mit Hilfe des Bor-Gehaltes*. Geochim. Cosmochim. Acta, 1958, 14, 211–222, 2 figs., (English summary).

In Carboniferous shales of the Ruhr, Germany, boron varies with the salinity of the water in which the shales were deposited: shales with marine fossils 0.03–0.06% B_2O_3 ; shales with freshwater fossils 0.005–0.015% B_2O_3 . Correlation in non-fossiliferous sequences of changes in salinity may be possible by determination of their B contents.

R. C.

BORCHERT (H.). *Deszendenz und synsedimentäre Senkung oder primäre Lagerbildung und Metamorphose bei den Kalklagerstätten des Oberrheintal-Grabens*. Neues Jahrb. Min., Abhandl., 1960, **94**, 636–661, 4 figs.

The deposition of the sodium and potassium salts and bituminous sediments of the upper Rhine 'Graben', near Mülhausen, did not depend on the sinking of the whole lagoon but on the differential tectonic movements of the 'barren' which connected the lagoon with the main basin and with the open ocean. The finest rhythms (Jahresringe) are climatic in origin. The facies variations are caused by post-sedimentary leaching.

R. A. H.

GRÜENFELDER (M.). *Erzmikroskopische Untersuchung der glazialen, erzführenden Ablagerungen zwischen Pura, Neggio und Ponte Tresa (Malcantone, Tessin)*. Neues Jahrb. Min., Abhandl., 1960, **94**, 620–626, 2 figs.

Ore cobbles of unknown origin in the Malcantone Pleistocene gravel of the southern Swiss Alps contain quartz, pyrite, blende, chalcopryrite, pyrrhotine, arsenopyrite, and tetrahedrite, with later intense fracturing and deposition of chalybite.

R. A. H.

PRZYBYŁOWICZ (T.). *Studium petrograficzne skal klastycznych Jury okolic Krakowa* [Petrography of the clastic Jurassic rocks in the Cracow region]. Arch Mineral., 1959, **22**, 133–183, 22 figs., 13 tables, (English summary).

From the detailed petrography it is concluded that the material of Dogger sediments of part of the Cracow-Częstochowa region was supplied by the local deposits of Bunter sandstone, Carboniferous sediments, and to a lesser degree by Permian and Liassic rocks. The heavy minerals of sands and sandstones show concentration of zircon and rutile in fine fractions 0.2–0.1 mm, 0.1–0.06 mm, and <0.06 mm. Minerals such as tourmaline, staurolite, and kyanite increase in quantity with increasing grain size and become concentrated in the fraction 0.6–0.75 mm. Garnet is found in the fractions 0.06–0.1 and 0.1–0.2 mm. Monazite appears in two fractions only 0.06–0.1 mm and 0.1–0.2 mm.

W. S.

BIRKENMAJER (K.). *Systematyka warstwowań w utworach flyszowych i podobnych* [Classification of bedding in flysch and similar graded deposits]. Stud. Geol. Pol., Warszawa, 1959, **3**, 1–128, 7 figs., 2 pls., (English summary).

The author attempts to establish a new classification and nomenclature of beddings, marks, and casts common in flysch and rocks of similar genesis. The results of his work are based on field study of sediments in the Polish and Czechoslovakian Carpathians as well as on study of literature dealing with these problems. A standard set of symbols for particular types of bedding is proposed; this would be helpful in comparing bedding in different regions.

W. S.

KOTAŃSKI (Z.). *Profile stratygraficzne sieci wierchoń Tatry Polskich* [Stratigraphical sections of the High Tatra series in the Polish Tatra Mountains]. Biulet. Inst. Geol., 1959, **139**, 1–139, 13 figs., 21 pls., (Polish with English summary).

Stratigraphical sections of the upper parts of the Tatra Mountains are described, and problems of sedimentation and variation of facies are discussed in detail. The silicification phenomena occurring in Lias at the Chocholowski valley are described.

W. S.

RADWAŃSKI (A.) & RONIEWICZ (P.). *Struktury na powierzchniach warstw a górnym Kambrze Wielkiej Wiśniówki pod Kielcami* [Ripple marks and other sedimentary structures in the Upper Cambrian at Wielka Wiśniówka]. Acta Geol. Pol., 1960, **10**, 371–388, 6 pls. (Polish with English summary).

Various structures such as ripple-marks and organogenic hieroglyphs (*Rhyzophycus*, *Cruziana*) are described from Upper Cambrian quartzitic sandstones exposed in some quarries at Upper Wiśniówka. The structures indicate deposition in shallow water under continuous activity of sea waves and weak littoral currents.

W. S.

TURNAU-MORAWSKA (M.). *Warstwy chalcedonowe Tremadoku Gór Świetokrzyskich. Studium petrograficzne* [Petrography of chalcedonites in the Świetokrzyskie Mountains (Central Poland)]. Roczn. Pol. Tow. Geol., 1959, **27**, 169–189, (Polish with English summary).

The Tremadoc series of the Świetokrzyskie Mountains are composed of rhythmically interbedded sandstones, siliceous stones, argillaceous cherts, rocks of the gaize type, and chalcedonites rich in sponge spicules. The primary source of silica came from the decomposed pelitic detrital material which floated in sea water during intervals in erosion processes on land. The silica gel was mixed at first with the pelitic detritus to form argillaceous cherts and in the second stage it formed chalcedonites. After renewal of erosion processes on land, coarse and fine detritus with sponge spicules provided material for sandstones and siltstones.

W. S.

EGENS (E. T.) & RUTTE (E.). *Geochemische Untersuchungen eines Kalkkrustenprofils von Altkorinth-Griechenland*. Neues Jahrb. Geol. Paläont., Monatshefte, 1960, 263-276, 5 figs., 1 table.

A band of carbonate deposition near Old Corinth, Greece, referred to as a calcareous crust, is exposed 1.2 metres below the top of a section of marly sediments. Its morphology and geologic setting are described. The band is 10 cm thick at the surface but is reduced to a thickness of 3 cm 2 metres from the surface. A 2.8 metre profile has been sampled, 5 samples above the band, 4 in it and 6 below, and the samples analyzed for Fe, Mn, Ca, Mg, P, K, Na, and CO₂. The results are presented in both graphical and tabular fashion. K and K/Na rise sharply just above the calcareous band. Mn/Fe is much higher below the band, largely because the Fe is lower here.

A. P.

EGENS (EGON T.), KNETSCH (GEORG), & REUTER (HELMUT). *Ein geochemisches Buntsandstein-Profil vom Schwarzwald bis zur Rhön*. Neues Jahrb. Geol. Paläont., Abhandl., 1960, **111**, 181-233, 16 figs., 7 tables, (English summary).

The Lower Triassic strata (Buntsandstein) of south-west Germany were investigated by geochemical methods. From the area studied, about 350 sq km, nearly 3000 analyses were made. The HCl-soluble material of clays and sandstones showed some relationship to source, environment, climate, and processes of transportation. Geochemical alteration by weathering was unimportant. Conclusions drawn from Ca/Mg, Mn/Fe, P/Fe, and K/Na ratios were in general agreement with geological field observations.

A. P.

MERY (K. O.) & NEEV (D.). *Mediterranean beaches of Israel*. Bull. Geol. Survey Israel, 1960, **26**, 23 pp., 4 figs., 2 tables.

The study includes grain size distribution, heavy mineral analysis, and other data of 34 beach, 8 dune, 2 sea floor, and 9 river sediment samples taken along the Mediterranean coast of Israel. Northward decrease in grain size and similarity in mineralogy is taken as evidence that the sands have been transported by longshore currents from the Nile river, with some contribution from streams and cliffs along the Sinai coast. Israel rivers add little material to the beaches. A similar pattern of sand provenance and movement is believed to have existed during the Pleistocene.

D. H. Y.

LATKINE (A.) & POMERANCEBLUM (M.). *Unstable heavy minerals as criteria of depositional environment*. Bull. Geol. Survey Israel, 1958, **19**, 11 pp., 3 figs., 3 pls.

A study of 356 samples from 14 boreholes, to a depth of

up to 150 metres, in the Tel-Aviv region of the Coastal Plain. The formation is mainly composed of sandy clastic sediments representing neritic, littoral, and continental environments. The major heavy minerals, in order of decreasing stability are zircon, rutile, tourmaline, staurolite, garnet, epidote, hornblende, and augite; kyanite, tremolite, sphene, sillimanite are rare. The frequency of the most unstable minerals, augite and hornblende, decreases in the continental facies due to weathering. Lateral variation in the frequency of the unstable minerals is a function of distance from the coast line and is interpreted as due to the variable time of immersion caused by oscillations of sea level. Corrosion marks and saw-tooth morphology of grains are considered evidence of intrastratal diagenetic solution. Provenance is not considered a significant factor in frequency variations.

D. H. Y.

RIM (M.). *Sand and soil in the Coastal Plain of Israel. A study of the rate of accumulation*. Israel Exploration Journ., 1950-51, **1**, 33-48, 3 tables.

The study includes particle size data and heavy mineral counts of 37 sand samples taken along the Sinai and Israel coast stretching from Suez to Lebanon. Magnetite, hornblende, augite, and epidote are the dominant heavy minerals. The beach sands are considered to have originated locally by surf activity. Grain size gradient along the smooth Sinai coast is considered as evidence of continuous removal and transportation northward of sand from these beaches. Northward increase in calcareous shell fragments along the Israel coast indicates importance of local material. The coastal currents moving the sands, and the mechanism of lifting and distribution of sand by wind inland have been investigated. The Nile and local rivers are not considered significant suppliers of sandy material today.

D. H. Y.

CHETIN (A. K.) & FITKIN (W. W.). *Geology of the Weyburn Field, Saskatchewan*. Trans. Canad. Inst. Mining & Metall., 1959, **62**, 401-411, 25 figs.

This comprehensive account includes detailed petrographical data on the sedimentary rocks associated with the oil pool.

G. P.

SILVERMAN (E. N.) & BATES (THOMAS F.). *X-ray diffraction study of orientation in the Chattanooga shale*. Amer. Min., 1960, **45**, 60-68, 3 figs.

Fifty-eight samples of 10Å illite and mica flakes from a drill core of the Chattanooga shale were studied by X-ray diffraction to obtain a quantitative measure of the degree of orientation of the (001) planes. From this study it was possible to determine the amount of 10Å material present. The amount of uranium in the rocks bore no significant relation to the texture, a result in agreement with the

hypothesis that the uranium was emplaced during the deposition of the shale.

A. C. H.

BAXTER (J. W.). *Salem limestone in southwestern Illinois*. Circ. Illinois State Geol. Survey, 1960, **284**, 32 pp., 6 figs., 3 pls.

The Salem Limestone has been divided into the Kidd member, a biocalcarenite; the Fults, an alternating fine-grained dolomitic limestone and calcarenite; the Chalfin, a variable member; and the Rocher, predominantly a calcarenite. The environment of Salem deposition probably was similar to that now existing on the Great Bahama Banks.

W. A. W.

MOBERLY (RALPH, Jr.). *Morrison, Cloverly, and Sykes Mountain formations, northern Bighorn Basin, Wyoming and Montana*. Bull. Geol. Soc. America, 1960, **71**, 1137-1176, 12 figs., 5 pls.

The Morrison, Cloverly, and Sykes Mountain are the uppermost Jurassic and lowermost Cretaceous sedimentary rocks in the northern Bighorn Basin. Mineral composition and texture, characteristic primary and secondary structures, clay, accessory and authigenic minerals, and gross stratigraphic distribution are utilized in an interpretation of the origin and history of these deposits.

A. L. A.

BARDLEY (A. J.) & GVOSDETSKY (VASYL). *Analysis of Pleistocene core from Great Salt Lake, Utah*. Bull. Geol. Soc. America, 1960, **71**, 1323-1344, 2 figs., 1 pl.

A continuous core was taken to a depth of 650 feet on the shore of Great Salt Lake about 18 miles west of Salt Lake City, Utah, to study the record of Pleistocene lakes and climatic changes. Percentages of Ca and Mg carbonates, illite, kaolinite, montmorillonite, and sand fraction were determined in 215 samples. Volcanic ashes, soils, radioactivity, laminations, oolites, faecal pellets, ostracods, molluscs, and ^{14}C dates were also used to formulate a Pleistocene history. Seven chemical and spectrographic analyses of volcanic ash are given, four from the core, and one each from the Pleistocene of Kansas, Utah, and Idaho.

A. L. A.

DANIELS (RAYMOND B.), HANDY (R. L.), & SIMONSON (G. H.). *Dark-colored bands in the thick loess of western Iowa*. Journ. Geol., 1960, **68**, 450-458, 5 figs., 1 pl.

The dark colour is attributed chiefly to the greater content of MnO_2 (average for 31 unbanded samples $0.174 \pm 0.013\%$ MnO_2 compared with average for 15 dark band samples $0.254 \pm 0.024\%$) and to spots which contain up to 1.4% MnO_2 . The dark bands also contain greater percentages of Fe_2O_3 and organic matter. They are

thought to represent periods of slow or no deposition of loess, but not necessarily true interstadial breaks.

R. E. W.

CARROLL (DOROTHY). *Mineral indicators of environment in sediments of part of the Maryland Coastal Plain*. Virginia Journ. Sci., 1959, **10**, 293-294.

A study of pyrite, chalybite, kaolinite, and corroded detrital staurolite, garnet, and tourmaline from the basal beds of early Cretaceous age (Potomac group) provides information on depositional environment.

R. S. M.

HUBERT (JOHN F.). *Syngenetic bleached borders on detrital red beds of the Fountain formation, Front Range, Colorado*. Bull. Geol. Soc. America, 1960, **71**, 95-98, 1 fig., 1 pl.

Bleached white arkose borders occur between red arkoses containing detrital hematite, and red mudstone in the Fountain formation. A similar border was observed enveloping a red mudstone cobble in red arkosic conglomerate. X-ray fluorescence analyses for total iron in 17 samples indicate that total iron in the white arkose borders is consistently lower than in the central portion of the red arkoses at each location and that iron has been concentrated in the red mudstone adjacent to the white borders in a narrow zone a few inches thick. It is believed that this process was syngenetic, possibly related to decaying plant material in the red mudstone.

A. L. A.

BARNETCHE (A.) & ILLING (L. V.). *The Tamabra limestone of Poza Rica oilfield, Veracruz, Mexico*. 20th Congr. Geol. Intern., México, 1956, 38 pp., 14 figs.

The huge Middle Cretaceous oil reservoir of Poza Rica is a stratigraphic trap caused by an abrupt facies change from lime-sands and lime-silts (Tamabra limestone) to lime-muds. The lithology, porosity, and permeability of the Tamabra limestone are described in detail; the more permeable parts of the formation have been selectively dolomitized.

R. A. H.

MACPHERSON (H. G.). *A chemical and petrographic study of Pre-Cambrian sediments*. Geochim. Cosmochim. Acta, 1958, **14**, 73-92, 10 figs.

Spectrographic determinations are given for B, Cr, V, Ni, Cu, Mn, and Ba in 92 Precambrian (Archaean and Proterozoic) argillaceous rocks, mainly greywackes and argillites but including some chlorite-schists and mica schists. Almost all the rocks are from Ontario and Quebec provinces, Canada. Trace element content favours a marine origin for the greywackes and argillites, and it is suggested that even the oldest of the Precambrian rocks were deposited in seas which did not differ markedly in

linity from those of Palaeozoic and later times. There is significant variation of trace element content with time. The rocks investigated, and a review of the Canadian literature, indicate that arkosic greywackes are the most common of Canadian greywackes. [M.A. 12-545] R. C.

AS (DILIP KUMAR). *The sedimentological studies of the Barakar sandstones of Talchir coalfield, Orissa*. Quart. Journ. Geol. Min. Met. Soc. India, 1959, **31**, 29-38, 7 figs.

Details are given of petrographical studies and mechanical analysis of sandstones. Depositional and environmental conditions are deduced. A. P. S.

GANGULY (SUBINOY). *A note on the heavy minerals of Barakar sandstones of Ramgarh coalfield, Hazaribagh District, Bihar*. Quart. Journ. Geol. Min. Met. Soc. India, 1959, **31**, 121-122.

In heavy mineral assemblages from sandstones several varieties of zircon, tourmaline, and garnet are recorded. The insignificant rounding of zircon and tourmaline is attributed to nearness of the source area and to lack of working of sediments. A. P. S.

EB (S.). *Microscopic characters of placer sand deposits in the neighbourhood of Cape Comorin, South India*. Quart. Journ. Geol. Min. Met. Soc. India, 1959, **31**, 223-226, 1 fig.

Descriptions of minerals in the sands under the polarizing and reflecting microscopes are given. A. P. S.

GANGULY (SUBINOY). *Dimensional fabric of Barakar and Barren Measures sandstone in eastern part of Ramgarh coalfield, Hazaribagh*. Quart. Journ. Geol. Min. Met. Soc. India, 1960, **32**, 39-46, 7 figs.

A statistical study of grain orientation was made to determine the direction of transportation of sediments. A. P. S.

BROTHERS (R. N.). *Heavy minerals from Southland [New Zealand]. Part I : Permian-Jurassic sediments*. New Zealand Journ. Geol. Geophysics, 1959, **2**, 622-633, 2 tables.

—— ——— *Part II : Upper Cretaceous-Lower Tertiary coal measures*. Ibid., 788-798, 3 tables.

Most of the heavy minerals in the Permian-Jurassic rocks are either stable detrital minerals which have escaped intrastratal solution, notably zircon, tourmaline, and apatite, or authigenic minerals, notably epidote. A wide variety of provenance is represented; there are strong flushes of certain minerals of igneous origin, but they have been partly altered by percolating solutions. The heavy minerals of the Tertiary coal measures suggest derivation from the immediately adjacent older rocks. The mineralogy of the heavy concentrates and the experimental methods are briefly described. W. A. W.

TOPOGRAPHICAL MINERALOGY

UNGGREN (PONTUS). *Todorokite and pyrolusite from Vermlands Taberg, Sweden*. Amer. Min., 1960, **45**, 235-238, 1 fig.

Todorokite and pyrolusite from this locality, compared petrographically and by d.t.a., were found to be very similar and to have very low content of trace elements. The strongest X-ray powder lines for todorokite are 9.67 *vs*, 7.8 *m*, 4.47 *vw*; these data are very similar to those given by Frondel [A.M. 38-761]. A. C. H.

EIBEL (M.). *Über Phenakit aus den Schweizer Alpen*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1241-1247, 3 figs.

A new occurrence of phenakite is reported from the Urka Pass, Sidelenbach, Uri, Switzerland. Phenakite occurrences in alpine fissures are reviewed, six of them being from the Aar and Gotthard massifs and one from the Hohe Tauern, Salzburg. The phenakite is always prismatic and associated with adularia, quartz, chlorite, apatite, and titanite. R. A. H.

HILLER (J.-E.) & WALENTA (K.). *Zwei Mineralien der Andorit-Ramdohrit-Fizelyit-Gruppe aus dem Schwarzwald*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1160-1168, 2 pls.

Two members of the andorite series occur in the Sb-ore vein of the Ludwig mine, near Hausbach, in the Black Forest, Germany, associated with stibnite, bournonite, semseyite, and other sulphosalts. Of the two andorite-type minerals one is untwinned and is andorite, the other mineral shows complex lamellar twinning and is probably fizelyite. X-ray powder data are tabulated. [M.A. 10-15] R. A. H.

ČECH (F.). *Occurrence of stokesite in Czechoslovakia*. Min. Mag., 1961, **32**, 673-675.

A second occurrence of the hydrous silicate of tin and calcium, stokesite [M.M. 12-274, 32-433], is recorded from a lithium-bearing pegmatite at Ctidružice near Moravské Budějovice, western Moravia. It is found as chalk-white

fibrous aggregate associated with cassiterite in a heavily albitized portion of the pegmatite containing also abundant quartz and accessory green tourmaline. R. A. H.

TEISSEYRE (H.), SMULIKOWSKI (K.), & JAHN (A.). *Regionalna geologia Polski. Sudety. Utwory Trzeciorzędowe i Czwartorzędowe oraz pogląd na rozwój budowy geologicznej Sudetów* [Regional geology of Poland. Sudetes. Tertiary and Quaternary formations, and a synthesis on the structural evolution of the Sudetes]. Pol. Tow. Geol., Kraków, 1960, **3**, 301-438, 17 figs., 4 pls., 3 maps. Price 35 zł. [approx. 11s.].

The Tertiary and Quaternary formations of the Sudetes and their north-eastern borderland are described. An attempt is made in this volume to synchronize the geology of various regions into a synthesis on evolution of Sudetes. One chapter is devoted to the readers who are not familiar with the Sudetes Mountains and their abundant geological bibliography. Twelve chemical analyses are given.

W. S.

SINKANKAS (JOHN). *Barcelona—a Spanish gemstone locality*. Rocks & Minerals, 1955, **30**, 121-123, 1 fig.

A brief description is given of jasper, rock crystal, opal, calcite, and limonite found in quarries on the hill of Montjuich, Barcelona, Spain. R. S. M.

ALBUQUERQUE (C. A. RIBEIRO DE). *Contribuição para o estudo morfológico do quartzo dos pegmatitos graníticos da Serra do Gerez*. Memórias e Notícias, Publ. Mus. Lab. Min. Geol., Univ. Coimbra, 1958, **45**, 14-21, 10 figs., 1 pl., (summaries in English and French).

The forms observed are described and figured. Dauphiné twins and multiple twinning are common. Smoky quartz crystals hooded by milky or ferruginous quartz are found.

J. Ph.

SANDERS (L. D.). *Geology of the Mid-Galana area*. Rept. Geol. Survey, Kenya, 1960 (for 1959), **46**, 1-50, 9 figs., 4 pls., 1 map.

The report describes an area 1,200 square miles in extent in south-east Kenya. Precambrian and Permian (possibly Carboniferous) to Triassic rocks are represented. The Palaeozoic rocks include a rock believed to be a tillite. Partial analysis of an upper Permian limestone gave CaCO_3 95.00, MgCO_3 0.80, SiO_2 2.12, and for a lower Permian limestone SiO_2 12.29, MgO 0.38. Manganese and iron mineralization occurs in shatter belts; a partial analysis of one breccia gave SiO_2 24.40, Fe_2O_3 41.28, MnO_2 0.96, CoO 0.02. Calcite veins also follow some of the fractures and contain traces of lead and zinc. An example from Kuwetu contains Fe_2O_3 1.08, $\text{CaO} + \text{MgO}$ 53.51, Pb tr., Zn 0.20, Ag nil.

W. P.

THOMPSON (A. O.) & DODSON (R. G.). *Geology of the Bu Mayo-Tarbaj area*. Rept. Geol. Survey, Kenya, 1960 **47**, 1-49, 6 figs., 4 pls., 3 maps.

The report describes an area 2400 square miles in extent in north-eastern Kenya. Precambrian, Triassic(?), Jurassic and Tertiary rocks are represented. Metamorphosed calcareous rocks are present in the Precambrian. A partial analysis of diopside from a wollastonite-diopside segregate gave SiO_2 51.91, Fe_2O_3 1.52, MgO 14.53, CaO 26.18. The Jurassic rocks are predominantly limestones and nine samples were found to contain MgO & CaO in the percentages 0.98, 51.25; 19.26, 28.12; 0.05, 51.66; 3.35, 49.86; 1.31, 50.69; 0.42, 50.69; 0.75, 51.53; 0.45, 52.08; 0.39, 49.86. A small amount of barytes was found on an eroded surface of Liassic limestones.

W. P.

WILLIAMS (K. L.). *A natural occurrence of nickel hydroxide*. Amer. Min., 1960, **45**, 1109-1110.

Nickel hydroxide was found as a finely banded intergrowth with zaraitite on a shear plane in a specimen of serpentinite from the Lord Brassey mine at Heazlewood Tasmania. X-ray diffraction pattern confirmed the identification.

A. C. H.

KULLERUD (G.), DONNAY (G.), & DONNAY (J. D. H.). *A second find of euhedral bornite crystals on barite*. Amer. Min., 1960, **45**, 1062-1068, 5 figs.

Bornite crystals were found on baryte at the Coppercorp mine, Ontario. The crystals are cubes truncated by octohedron faces and are twinned in two ways, one simulating cubic symmetry, with cell edge $a = 21.94\text{\AA} \pm 0.06$, the other simulating orthorhombic symmetry with $a = 21.90\text{\AA} \pm 0.06$, $c = 10.95\text{\AA} \pm 0.03$.

A. C. H.

CHROMY (BEN J.). *Lawsonite crystals on Tiburon Peninsula, California*. Rocks & Minerals, 1955, **30**, 130-132, 4 figs.

Lawsonite crystals occur in narrow crevices in schist of Tiburon Peninsula, Marin County, California. The locality is briefly described.

R. S. M.

MARCIN (E. J.). *Florida minerals*. Rocks & Minerals, 1961 **36**, 27-28.

An outline of the minerals, about 35, known to occur in Florida is presented. Special attention is given to phosphate minerals, beach sands, fossils in chalcidony, cave formations, and selenite crystals.

R. S. M.

ANON. *Illinois fluorspar*. Rocks & Minerals, 1961, **36**, 15-17 & 48, 2 figs.

A brief survey is given of the fluorite deposits in Hardi

and Pope Counties in southern Illinois. The history, occurrence, production, and uses of the fluorite are reviewed.

R. S. M.

WIFT (ELLSWORTH R.). *Crystals by the ditchful*. Rocks & Minerals, 1961, **36**, 22–26, 4 figs.

Numerous selenite rosettes, made up of well-defined crystals ranging in size from a fraction of an inch to about four inches, as well as individual crystals, occur in Patapsco clay (Cretaceous) in Prince Georges County, Maryland, about 10 miles south of Washington, D.C., and near Fort Foote. Comments are given on a possible mode of formation of the crystals.

R. S. M.

GOSSE (RALPH C.). *Brown jasper in Massachusetts*. Rocks & Minerals, 1961, **36**, 14.

Jasper occurs over a wide area in the northwestern part of Massachusetts.

R. S. M.

ALFREDO (DON). *Halite*. Rocks & Minerals, 1955, **30**, 115–120, 5 figs.

Zuni Salt Lake, northwest of Quemado, New Mexico, and the halite specimens obtained from it are described.

R. S. M.

FISHER (C. C.). *A summary of Virginia's mineral resources*. Virginia Minerals, 1954, **1**, 1–4.

R. S. M.

VARIOUS TOPICS

KUNO (HISASHI). *Discussion of paper by J. F. Lovering, 'The nature of the Mohorovicic discontinuity'*. Journ. Geophys. Res., 1959, **64**, 1071–1072.

The world-wide occurrence of peridotite inclusions in basalt indicates that the crust is underlain by rocks which are predominantly peridotite, contrary to Lovering's view [M.A. **14**–449] that the upper mantle is composed of eclogite. In Hawaii and Japan gabbro inclusions in basalt are never associated with eclogite inclusions, though this might be expected if a gabbro layer in the earth were directly underlain by eclogite.

F. R. B.

LOVERING (J. F.). *Reply to Kuno's discussion of 'The nature of the Mohorovicic discontinuity'*. Journ. Geophys. Res., 1959, **64**, 1073.

In replying to Kuno's argument [preceding abstract] that gabbro and eclogite inclusions in basalt are not found together in Hawaii and Japan, Lovering cites the association of eclogite, gabbro (or pyroxene granulite), and subordinate peridotite inclusions in alkali basalts in eastern Australia.

F. R. B.

KOVACH (R. L.). *Surface wave dispersion for an Asian-African and a Eurasian path*. Journ. Geophys. Res., 1959, **64**, 805–813, 9 figs., 1 table.

An average crustal thickness of slightly less than 40 km along a path across northern Asia, Europe, and Africa was obtained from Love and Rayleigh wave dispersion data of an Aleutian shock on March 20, 1958, recorded at Lwiro, Belgian Congo, and Pietermaritzburg, South Africa. The antipodal path is across the Pacific and South Atlantic and a mean sediment thickness of 0.8 km was estimated. Analysis of Uppsala, Sweden, seismograms of the Sinkiang, China, shock of June 24, 1958, indicates an average crustal

thickness of about 45 km for this path, in agreement with available Russian refraction measurements.

F. R. B.

HOLLÄNDER (E. E.). *The basic equations of the dynamics of the continuous distribution of dislocations. I. General theory*. Czech. Journ. Phys., 1960, **B10**, 409–418: *Ditto. II. Interpretation of general theory*. Op. cit., 479–487. *Ditto. III. Special problems*. Op. cit., 551–560.

J. N.

ŠESTÁK (B.) & LIBOVICKÝ (S.). *The formation of dislocations by a spark discharge*. Czech. Journ. Phys., 1960, **B10**, 759–764, (English with Russian summary).

The arrangement of dislocations formed in a single crystal of the alloy Fe–4.2% Si by a spark discharge in air is studied. The dislocations are made visible by etching on the surfaces perpendicular and parallel to the axis of the crater. The results of the observations are explained on the basis of microphysical conceptions of plastic deformation. [Author's abstract]

J. N.

CORNET (I.) & GÖRUM (A. E.). *The observation of fatigue processes in MgO single crystals*. Trans. Metall. Soc., A.I.M.E., 1960, **218**, 480–485, 11 figs.

It is shown that under cyclic stress, dislocations in magnesium oxide single crystals move irreversibly; they multiply; slip bands form and grow; cracks nucleate and propagate; and failure occurs. Individual dislocation intersections with pinacoid surfaces may be observed with a standard microscope, using etching techniques. Slip, deformation, crack formation, and fracture in MgO crystals under cyclic stress are compared with corresponding processes in metals.

R. G. Wls.

DE VORE (G. W.). *Role of minimum interfacial free energy in determining the macroscopic features of mineral assemblages. I. The model.* Journ. Geol., 1959, **67**, 211-227.

Interfacial free energy may be important during nucleation, crystal growth, exsolution, replacement, and diffusion. Because the average energy of a crystal in a mixed aggregate increases during growth, effective concentration must also increase to enable continued growth. Thus grain size and character of contacts are influenced. R. E. W.

WADSWORTH (M. E.), LEITER (K. L.), PORTER (W. H.), & LEWIS (J. R.). *Sulfating of cuprous sulfide and cuprous oxide.* Trans. Metall. Soc., A.I.M.E., 1960, **218**, 519-525, 6 figs.

The oxidation of Cu_2S in oxygen and the sulfating of Cu_2O in oxygen-sulfur dioxide atmospheres was carried out under a variety of conditions. The oxidation of Cu_2S was found to be retarded by entrapment of SO_2 and O_2 , which stabilized internal sulfates for long periods of time. The course of the reaction was followed by measuring weight changes and also by SO_2 evolution. Sulfating of Cu_2O was a maximum at ratios of SO_2 to O_2 approximating maximum SO_3 production. At elevated temperatures SO_2 was found to increase the ratio of oxidation of Cu_2O to CuO even though sulfates did not form. All sulfating reactions followed the parabolic rate law indicating diffusion. R. G. Wls.

QUETS (J. M.), WADSWORTH (M. E.), & LEWIS (J. R.). *Kinetics of hydrogen reduction of magnetite.* Trans. Metall. Soc., A.I.M.E., 1960, **218**, 545-550, 4 figs.

Samples of magnetite were reduced in hydrogen at various partial pressures and temperatures. The reaction was found to be surface controlled and directly proportional to hydrogen partial pressure over the temperature range studied (400° to 1000°C). A transition in the mechanism occurred at approximately 590°C which was attributed to a change in the slow step of the reduction reaction resulting from the presence of stable wüstite at higher temperatures. Below 590°C the heat of activation for the reaction was found to be 14 700 cal per mole and it was 3 700 cal per mole above 590°C . R. G. Wls.

ITO (KENZO). *On the maghemite in the effluent fume from the open-hearth furnace.* Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 203-207, 3 figs., 2 tables, (Japanese with English summary).

Mineralogical study was made of the red iron oxide fume given off by the open-hearth furnace in which pure oxygen was injected into the molten iron to speed up the steel-making reactions. Chemical analysis, d.t.a., X-ray powder

data, and electron-microscopic observations of the material suggested that it was mainly composed of maghemite, which has a 8.362\AA and transforms to hematite at some temperature between 200°C and 500°C . I. S.

[DILAKTORSKIĬ (N. L.) & KIĬLER (M. A.)] Дилакторский (Н. Л.) и Кийлер (М. А.) О расслоении расплавов золы сланца-кукерсита [*On liquation of ash melts of kukersite shale*]. Труды пятого сов. эксп. техн. мин. петр. [Trans. fifth conf. exper. techn. min. petr.], Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1958, pp. 201-207, 6 figs.

Kuckersite, a variety of bituminous shale, is found in Estonia. It contains about 60% of mineral matter, which, after being fired, is used for the preparation of various building materials. During firing marcasite contained in the mineral matter is oxidized into a series of sulphates, CaSO_4 , K_2SO_4 , and Na_2SO_4 . Above 1200°C the ash begins first to sinter and then to melt with separation of a liquid sulphate fraction floating on the liquid silicate fraction. The scientific and the technological aspects of this process are discussed. [M.M. 20-458] S. I. T.

[IVANOV (B. V.)] Иванов (Б. В.). Химико-минералогические изменения каолинового огнеупора в процессе службы в стекловаренных печах [*Chemical-mineralogical changes in kaolinite refractories in the course of work in glass-making furnaces*]. Труды пятого сов. эксп. техн. мин. петр. [Trans. fifth conf. exper. techn. min. petr.], Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1958, pp. 253-272, 13 figs.

Experiments on bars, made of kaolinite and clay, placed on various levels within a glass furnace, revealed various types of corrosion, zone formation, and flow crust formation, from which various minerals, such as nepheline, diopside, periclase, and wollastonite, as well as glass, are described. Chemical and optical data are provided. S. I. T.

[BEZBORODOV (M. A.) & КОНОПЕЛ'КО (I. A.)] Безбородов (М. А.) и Конопелько (И. А.). Кристаллизационная способность стекол, синтезированных на основе легкоплавких глин Белорусской ССР [*The crystallization capacity of glass produced from low-melting clays of the Byelorussian S.S.R.*]. Труды пятого сов. эксп. техн. мин. петр. [Trans. fifth conf. exper. techn. min. petr.], Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1958, pp. 348-358, 6 figs.

Commercial glass made from banded alkali-rich clays was studied by means of glass rods submitted to graduated temperatures up to 1200°C . A large number of samples were tested. Within this field of enquiry clays with a low

value of $\text{CaO} + \text{Al}_2\text{O}_3$ possessed the best crystallization capacity. Increase of CaO at the expense of SiO_2 or Na_2O displaced the glass from the field of primary wollastonite into the field of tridymite and lowered the crystallization capacity. For glasses situated along the wollastonite-tridymite join the lowering of Na_2O has but little effect, while the addition of MgO considerably increases the crystallization capacity. The recording of the position of the 'zero meniscus', which separates liquid from solid, is of great importance because it is situated within the field of the maximum of crystallization capacity. S. I. T.

АВЕТИКОВ (V. G.) [Аветиков (В. Г.)]. Роль окиси магния в стеатитовой керамике [*The role of magnesium oxide in the steatite ceramics*]. Труд пятого сов. эксп. техн. мин. петр. [Trans. fifth conf. exper. techn. min. petr.], Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1958, pp. 424-430, 4 figs.

Magnesium oxides, in contrast to other oxides are distributed between the crystalline (clinoenstatite) and the glassy phases of the steatite electroinsulation ceramic products. The work was carried out on samples containing variable proportions of MgO and its effect was traced on the phase composition of the porcelain and its properties. S. I. T.

ЖИЛИН (A. I.) & КРУЧИНИН (Yu. D.) [Жилин (А. И.) и Кручинин (Ю. Д.)]. О некоторых свойствах шлаковых расплавов и полученного из них литья [*On certain properties of slag melts and their cast products*]. Труды пятого сов. эксп. техн. мин. петр. [Trans. fifth conf. exper. techn. min. petr.], Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1958, pp. 431-440, 12 figs.

Three Uralian blast furnace slags (SiO_2 35.00, 34.64, and 31.70, the last with TiO_2 8-10%) were studied in liquid and solid states. In the liquid state viscosity and electroconductivity, in the solid state composition, texture, chemical stability, and mechanical properties were studied. Solid samples were heated at 800°, 900°, 1000°, and 1100°C for various periods of time and their composition and degree of crystallinity examined. Melilite in various forms appeared to be the dominant mineral. S. I. T.

ЯКОВЛЕВА (M. E.) [Яковлева (М. Е.)]. Взаимодействие некоторых силикатных глазурных расплавов с керамикой при температурах обжига 1000°-1250° [*The interaction of certain silicate glaze melts with ceramics at temperatures of firing 1000°-1250°C*]. Труды пятого сов. эксп. техн. мин. петр. [Trans. fifth conf. exper. techn. min. petr.], Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1958, pp. 441-451, 9 figs.

The interaction between porcelain and three types of

glaze mixtures—alkali-silicate, lead-silicate, and alkali-boron-silicate—was studied at 1000°, 1150°, and 1250°C. Chemical compositions of the glaze mixtures before and after firing are given, and chemical changes in the glaze on firing, as well as the minerals formed at the junction of the glaze and the porcelain, are noted. The newly formed minerals include plagioclase, gahnite, enstatite, various modifications of Al_2O_3 , and spinel. S. I. T.

[BRON (V. A.)] Брон (В. А.). О влиянии кристаллохимических свойств добавок на спекание высокоогнеупорных окислов в твердой фазе [*On the influence of crystallochemical properties of additions on the sintering of high refractory oxides in a solid phase*]. Труды пятого сов. эксп. техн. мин. петр. [Trans. fifth conf. exper. techn. min. petr.], Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1958, pp. 471-478, 3 figs.

This is a study of the effect of the addition of various cations on the sintering properties of MgO , CaO , Al_2O_3 , and SiO_2 . It is found that the effectiveness of the added cations depends on (1) valency and energy coefficient of the added cation which must be greater than those of a given oxide, (2) the difference between the radii of these cations which must not be greater than 25%, (3) ratio of the cations which must be greater than 1. Most effective are the cations arranged along the diagonals of the periodic table. Other relations are discussed. S. I. T.

WILLIAMS (A. E.). *Quartz for I.C.B.M.* Mining Mag., 1960, 103, 214-217, 3 figs.

Specially prepared quartz in a finely-divided condition with a binder can withstand temperatures in excess of 12 000°F and is used as heat-shielding material on a ballistic missile nose-cone. Details are given of the process of reducing the quartz to the necessary degree of fineness, involving a centrifugal air separator. R. A. H.

WARREN (H. V.) & DELAVault (R. E.). *Aqua regia extractable copper and zinc in plutonic rocks in relation to ore deposits*. Trans. Inst. Mining & Metall., 1960, 69, 495-504, 2 figs.

A hot aqua regia attack on 88 plutonic rocks showed wide variations in their Cu and Zn contents. This may be a useful technique for the correlation of various igneous formations where only scattered outcrops occur showing through drift. R. A. H.

BARRER (R. M.) & REES (L. V. C.). *Self-diffusion of alkali metal ions in analcite*. Trans. Faraday Soc., 1960, 56, 709-721, 7 figs.

A study of the self-diffusion of Na, K, Rb, and Cs ions in the respective cationic forms of analcime shows that the

self-diffusion coefficients become rapidly smaller with increasing ion size. Although previous studies [M.A. 11-291] have shown negligible exchange of Cs and Na between solutions and analcime crystals, the small but measurable self-diffusion coefficient of Cs suggested that slow exchange should be possible and this has been confirmed experimentally. Exchange diffusion for Na and K in analcime did not show the expected correlation with the self-diffusion coefficients of these ions; possible reasons for this are discussed.

R. A. H.

SUZUKI (TOSHIKI). *Studies on the ring ores of sulphur deposits*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1958, **42**, 272-279, 6 figs., 1 table, (Japanese with English summary).

Ring ores which occur in sulphur deposits have been studied. They are classified into two types; lava type and shale type. The lava type is considered to have been formed by replacement along the onion-like cracks of the original rocks, rather than by Liesegang phenomena. The shale type is considered to have been formed by inward diffusion of the reacting solution.

I. S.

SUDÔ (TOSHIO). *Cherty nodules associated with iron-manganese deposits in cherty rocks*. Japanese Journ. Geol. Geogr., 1953, **23**, 109-116, 4 figs., 1 pl.

Cherty nodules are associated with the iron-manganese deposits in cherty rocks at Ôtsu-mura, Shita-gun, Shizuoka Prefecture. Chemical analyses of the red and green parts of the nodules are reported. The nodules are composed of extremely fine-grained quartz, chlorite, and hematite.

A. P.

UKAI (YASUO), NISHIMURA (SHIN'ICHI), & MAYEDA (TAKASHI). *Mineralogical study on manganese dioxide minerals*. Mem. Coll. Sci., Univ. Kyoto, ser. B, 1956, **23**, 203-222, 7 figs., 8 tables.

Chemical analyses and densities are reported for nine manganese dioxides (including 3 pyrolusites, 2 cryptomelanes, a δ -phase and 3 mixed materials) from localities in Japan. X-ray powder diffraction patterns and d.t.a. curves are reported for these and for artificial γ -MnO₂. Thermobalance curves and deoxidation curves are reported for 5 specimens. The characteristics of dry cells manufactured from each of the natural oxides are tabulated.

A. P.

URASIMA (YUKITOSI). *On the silica minerals of the Abuta mine in Hokkaido, Japan*. Journ. Fac. Sci., Hokkaido Univ., 1959, ser. iv, **10**, 235-254, 5 figs., 4 tables.

Chalcedony and quartz are characteristic of the silicified

rocks, so-called hard iron sulphide ores, and recent bog limonite ore. Opal and cristobalite are abundant only in the wall-rocks near the ore bodies and the sulphur ores.

A. P.

GRIFFITHS (JOHN C.). *Frequency distributions in accessory mineral analysis*. Journ. Geol., 1960, **68**, 353-365, 1 fig.

The frequency distribution of accessory minerals in a set of samples is a fundamental characteristic for establishing whether the samples are representative of a rock unit. Counts to determine the frequency distribution of the occurrence of accessory heavy minerals in sediments may lead to binomial, Poisson, or negative binomial distributions. The binomial distribution is a likely model if the frequency of an accessory mineral species in a count of 100 grains lies somewhere in the range 10-90. The Poisson distribution is an appropriate model if the accessory mineral species is rare but the number of grains counted is very large. The negative binomial distribution is a likely model if the occurrence of one grain tends to lead to concentration of grains as, for example, where heavies occur in pay streaks. A set of data may be 'fitted' to these model distributions, the closeness of fit being tested by chi-square. Attempt at fitting the Poisson, mixed Poisson, and negative binomial distributions to estimates by five operators of the frequency of zircon in 360 samples of Oswego sandstone from a single outcrop (at Skytop, Route 322, Centre County, Pennsylvania) failed, apparently due to non-random variation among the various estimates. The statistical procedures for fitting these frequency distributions are described in detail.

H. E. M.

CLARK (JOAN R.). *X-ray study of alteration in the uranium mineral wyartite*. Amer. Min., 1960, **45**, 200-208, 2 figs.

The nature of the alteration is still unknown but a plausible explanation could be the oxidation of U⁴⁺ to U⁶⁺ with the formation of uranyl ions, possibly accompanied by some dehydration. [M.A. 14-280]

A. C. H.

PEARE (ROBERT K.). *A discussion of iron oxide pseudomorphs after pyrite metacrysts in the piedmont schists of Virginia*. Virginia Journ. Sci., 1959, **10**, 290-291.

Over four thousand pseudomorphs were collected from 23 localities in a belt extending from Jeffersonton, in Culpeper County, southwestward approximately 120 miles to the Roanoke River. X-ray diffraction and polished section studies show that pyrite is replaced by goethite, hematite, and magnetite. The supergene replacement occurred along the {001} and occasionally along the {111} cleavage directions of the original pyrite. A paragenetic sequence is suggested.

R. S. M.

INLAN (JAMES F., Jr.). *Monocrystalline speleothems*. Virginia Journ. Sci., 1959, **10**, 294.

Factors which influence the formation of calcite speleothems are outlined.
R. S. M.

ROBERTS (CLARENCE E.) & FARMER (GEORGE T., Jr.). *Description of the concretions from the Millboro black shales*. Virginia Journ. Sci., 1959, **10**, 295-296.

Several types are described. Septarian structures are common. Commonly observed minerals are baryte, calcite, and pyrite.
R. S. M.

ENDRICKSON (G. E.) & KRIEGER (R. A.). *Relationship of chemical quality of water to stream discharge in Kentucky*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **1**, 66-75, 6 figs.

The relative concentrations of different ions vary as elements of discharge from the various rock formations drained by headwaters and tributaries reach the sampling point.
R. A. H.

INGERY (W. D.). *On the metamorphism of snow*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **21**, 81-89, 4 figs.

R. A. H.

EVENSON (JOHN S.). *Mineralogy and the field geologist*. Canad. Min., 1959, **6**, 303-306.

R. B. F.

HA (A. K.). *Decrepitometric studies on some granites and paragneisses from southeastern Ontario*. Canad. Min., 1959, **6**, 357-362, 1 fig., 3 tables.

Quartz and quartz + feldspar from the granites and paragneisses in and around the Wollaston and Chandos Lake plutons have been examined by the decrepitometric technique of Smith [M.A. **12**-176, 272] and Peach [M.A. **12**-21]. The decrepigraphs show several temperature stages of decrepitation, the highest being taken as representing the temperature of formation of the rock (uncorrected for pressure). The results suggest that the formation temperature was about 680°C (granite), 657°C (biotite-paragneiss). One of the stages of decrepitation may be used to distinguish granite from granitized paragneiss with the limitations (1) that the stage of granitization should not be too advanced, and (2) that the numerical rates of decrepitation obtained for the rocks examined may not be applicable to other areas.
R. B. F.

SMITH (F. G.) & LITTLE (W. M.). *Filling temperatures of H₂O - CO₂ fluid inclusions and their significance in geothermometry*. Canad. Min., 1959, **6**, 380-388, 5 figs., 1 table.

A theoretical treatment of the significance of the filling temperatures of inclusions containing water and CO₂ is given following that given for water-water vapour inclusions by the first author [M.A. **12**-300]. Whereas in the water-water vapour case, the filling temperature gives only a minimum temperature of formation, in the water-CO₂ case the authors conclude from schematic phase diagrams that the filling temperature gives the actual temperature of formation when, two phases being present originally, either the water-rich phase only or the CO₂-rich phase only is entrapped. Criteria for determining whether one or two phases were probably present at the time of formation are given. Six samples of minerals from tin deposits thought to conform to the required conditions yielded temperatures in the 300°-400°C range.
R. B. F.

DEICHA (G. A.). *Participation de fluides minéraux d'origine profonde au cycle du carbone*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **1**, 7-9.

Water and CO₂ are the essential constituents of the liquid and gas inclusions in minerals derived from deep in the lithosphere. The CO₂/H₂O ratios of such inclusions and the geochemical cycle of carbon are briefly discussed.
R. A. H.

ROEDDER (E.). *Fluid inclusions as samples of the ore-forming fluids*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **16**, 218-229, 6 figs.

Some inclusions in ore and gangue minerals, at the time of trapping, contained the identical fluid from which the ore and host minerals were precipitating. If decreasing temperature was a significant factor in causing precipitation of the ore minerals in the deposit, these should also continue to precipitate from the fluid within the inclusions, upon further cooling to surface conditions. Such precipitated mineral grains are very rarely seen and it is concluded that the ore-forming fluids contain only very small amounts of the ore metals, possibly in the range of 0.001-0.01 g/litre up to a maximum of 0.1 g/litre.
R. A. H.

[Laz'ko (E. M.)] Лазько (Е. М.). Замечания о генетическом значении некоторых типов твердых минеральных включений в кварце [*Remarks on the genetic significance of some types of solid mineral inclusions in quartz*]. Мин. сборник Львов. Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1958, **12**, 106-115, 10 figs., (English summary).

Inclusions of crystalline minerals in quartz and also surface 'powderings' are described. These minerals are classed as protogenetic and syngenetic. Crystals of chlorite, hematite, pyrite, rutile, tourmaline, and 'quartz in quartz' are described; their significance on the genetic history of the quartz 'host' is discussed.
S. I. T.

[KALYUZHNYĬ (VL. A.)] Калужный (Вл. А.). К изучению состава минералов-«узников» многофазовых включений [The study of the composition of minerals-'prisoners' of polyphase inclusions]. Мин. Сборник Львов. Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1958, **12**, 116-128, 16 figs., (English summary).

Solid minerals formed from the mother solutions of liquid inclusions are called 'minerals-prisoners', while minerals formed in the liquid inclusions prior to their isolation, are called 'minerals-sputniks' (minerals fellow-travellers). Thirty-one minerals of these two types are described in detail, which includes optical and other properties as well as relative solubilities in the liquid of the inclusion in which the minerals are formed. The host mineral in all cases was topaz from a pegmatite, and the mineral inclusions included halite, sylvine, elpasolite, cryolite, quartz, as well as a number of undetermined species.

S. I. T.

McCulloch (DAVID S.). *Vacuole disappearance temperatures of laboratory-grown hopper halite crystals*. Journ. Geophys. Res., 1959, **64**, 849-854, 4 figs., 1 table.

Vacuole disappearance-temperatures in liquid inclusions in synthetic halite crystals were determined for the growth-temperature range 50° to 100°C. Surface-grown hopper halite crystals similar to those found in nature were obtained by evaporating sea water at a series of temperatures for about 24 hours. The highest disappearance-temperatures of the vacuoles are above the growth-temperatures for the halite which was grown below 72°C, and below the growth-temperatures for that grown above 72°C. The maximum deviation of about 15° is at the lower end of the temperature range studied. It is suggested that anomalously high disappearance-temperatures may be due to the presence of CO₂, whereas vacuole disappearance-temperatures below growth-temperatures may be due to leakage of brine into liquid inclusions.

F. R. B.

KOSTOV (IVAN). *Composition and paragenesis of zeolitic minerals*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **17**, 122-127, 3 figs.

Revised, simplified formulas of the zeolites are shown in a diagram using the atomic ratios Al/Si and Na/Ca as variables. Al/Si varies from 2/2 to 2/10. Na/Ca is 1/0, 1/1, 1/3 or 0/1. A diagram shows the relationship between the ratio Al/Si and Gruner's energy index [M.A. **11**-407] for calcium zeolites. Zeolites of high energy index are considered to have been formed at higher temperatures than zeolites of low energy index.

H. M.

PHILIPSBORN (H. v.) & HODENBERG (R. F. v.). *De Universaldrehtisch als Instrument zum Vermessen sehr kleiner Kristalle (8-10μ). Bestimmung der Kristallformen des Whewellit bei 'pseudotetraedrischer' Ausbildung*. Zeits. Krist., 1959, **111**, 81-93, 7 figs.

Using a Zeiss universal stage with × 40 objective the so-called pseudo-tetrahedra of monoclinic whewellite found in plant cells are shown to be combinations of $m\{110\}$ and $x\{011\}$. These forms develop only two faces each and therefore give rise to a pseudo-disphenoid with clear monoclinic character; only the pseudo-lefthanded form was observed.

R. A. H.

WEBLEY (D. M.), DUFF (R. B.), & MITCHELL (W. A.). *A plate method for studying the breakdown of synthetic and natural silicates by soil bacteria*. Nature, 1960, **188**, 766-767, 1 fig.

M. J. Le B.

HARRISON (E. R.). *Origin of the Pacific Ocean: a meteorite impact hypothesis*. Nature, 1960, **188**, 1064-1067.

M. J. Le B.

GILVARRY (J. J.). *Origin and nature of lunar surface features*. Nature, 1960, **188**, 886-891, 3 figs.

It is shown that the origin of many features on the moon and some aspects of tektites, can be explained in terms of the former presence of a lunar hydrosphere. A full account will appear elsewhere.

M. J. Le B.

GREEN (JACK) & POLDERVAART (ARIE). *Lunar defluidization and its implications*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **21**, 15-33, 13 figs.

A theory of lunar defluidization is suggested to account for the moon's surface features. Thick dust and welded tuffs probably cover the non-maria areas; predominantly volcanic flows occur in the maria. Surface rocks probably include rhyolite and basalt. Water-soluble elements, and K, U, and Th, are probably concentrated in lunar surface rocks. Sublimates of certain volatile elements may be abundant in the non-maria areas.

R. A. H.

PHILLIPS (H. F.) & BREGER (I. A.). *Isolation and identification of an ester from a crude oil*. Geochim. Cosmochim. Acta, 1959, **15**, 51-56, 2 figs.

This is the first reported occurrence of an ester in crude oil. A branched chain dioctylphthalate has been isolated from a crude oil from Utah, U.S.A.

R. C.

ABBREVIATIONS AND SYMBOLS

used in the text of abstracts

M.M. . . . Mineralogical Magazine : M.A. . . . Mineralogical Abstracts : A.M. . . . American Mineralogist

CHEMICAL & PHYSICAL-CHEMICAL

cation-exchange-capacity	.. ..	c.e.c.
differential thermal analysis	.. ..	d.t.a.
equivalent U_3O_8	.. ..	eU_3O_8
ethylenediaminetetra-acetic acid	.. ..	EDTA
heat of formation (absolute temperature subscript)	.. ..	ΔH_f
ionic potential, e.g.	.. ..	pH
insoluble residue	.. ..	insol. res.
isotopes, e.g.	.. ..	^{40}Ar , ^{40}K
loss on ignition	.. ..	ign. loss
milliequivalent	.. ..	me.
microgramme	.. ..	μg
million-years	.. ..	m.y.
not determined	.. ..	n.d.
not found	.. ..	nt. fd.
not present	.. ..	nil
parts per million	.. ..	p.p.m.
strength of solution, normal	.. ..	N
— — — molar	.. ..	M
substances in ionic state		
anions, e.g.	.. ..	Cl^- , SO_4^{2-}
cations, e.g.	.. ..	K^+ , Fe^{2+}
valency, e.g.	.. ..	Cl^I , Fe^{II} , Fe^{III}

CRYSTALLOGRAPHIC & STRUCTURAL

Ångstrom unit (10^{-8} cm)	.. ..	Å
crystal axes	.. ..	a , b , c
— face indices	.. ..	(hkl)
— form indices	.. ..	{hkl}
— zone indices	.. ..	[hkl]
indices of X-ray diffractions	.. ..	hkl
intensity,	.. ..	I
— relative	.. ..	I/I_0
interplanar spacing	.. ..	d
mica structural polymorphs	.. ..	$1M_1$, $2M_1$
Siegbahn units	.. ..	kX
space group. These words will be written in full	.. ..
unit cell, formula units	.. ..	Z
— — repeat distances	.. ..	a , b , c
— — reciprocal lattice lengths of edges	.. ..	a^* , b^* , c^*
— — interaxial angles	.. ..
— — — direct lattice	.. ..	a , β , γ
— — — reciprocal lattice	.. ..	a^* , β^* , γ^*

OPTICAL

dispersion, e.g.	.. ..	$r > v$
extinction angle, e.g.	.. ..	$\gamma : c$
optic axial angle	.. ..	$2V$
— — plane	.. ..	O.A.P.
refractive index, in text	.. ..	refr. ind.
— — of isotropic mineral	.. ..	n
refractive indices		
of uniaxial mineral	.. ..	ω , ϵ
of biaxial mineral	.. ..	α , β , γ
sign of biaxiality		
negative	.. ..	— or $2V_\alpha$
positive	.. ..	+ or $2V_\gamma$

PHYSICAL (other)

calorie	.. ..	cal.
calorie, large	.. ..	kcal.
cycles per second	.. ..	c/s
degree centigrade	.. ..	$^{\circ}C$
density	.. ..	D (quote units)
— , relative, e.g.	.. ..	D_4^{20}
gramme	.. ..	g
hardness	.. ..	H.
melting-point	.. ..	m.p.
micron (10^{-4} cm)	.. ..	μ
millimicron (10^{-7} cm)	.. ..	m μ
pounds per square inch	.. ..	lb/in 2
soluble	.. ..	sol.
specific gravity, terms of reference not known		
known	.. ..	sp. gr.
wavelength	.. ..	λ

SYMBOLS

approximately equal to	.. ..	\approx
equal to	.. ..	$=$
equal to or greater than	.. ..	\geq
equal to or less than	.. ..	\leq
greater than	.. ..	$>$
less than	.. ..	$<$
not equal to	\neq
parallel to	\parallel
per cent.	%
per mille	‰
perpendicular to	\perp
proportional to	\propto

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